THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XIX. No. 468—22ND YEAR.] LONDON, SEPTEMBER 13, 1870. [Subscription per Annum. { 15s. in Advance. 18s. Credit.] DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL
COAL. Analysis—
10,000 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.

GAS-RETORTS, introduced 1828.
FIRE-BRICK WORKS, established 1804.
FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay.
The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article.
The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary, and have come into general use more rapidly than any Meters hitherto manufactured.

PARIS EXHIBITION, 1867.
THE TESTING-HOUSE REPORTS.

The Reports prepared for the Science and Art Department, under the direction of the Lords of the Council, detail the arrangements made for testing the gas apparatus exhibited. In the testing-house erected by the Special Committee appointed to further this object a gasholder was constructed by Mr. G. Glover, being a *fac simile* of that produced and patented by him in 1860, and deposited in the Exchequer, under the provisions of the Sales of Gas Act, and British manufacturers of gas apparatus were invited by advertisement, and by direct application, to forward worthy objects for exhibition. Mr. G. Glover was, however, the only manufacturer who sent Meters to be tested. The report states that, as "Mr. Glover is a manufacturer of Dry Meters only, no opportunity presented itself of comparing their accuracy with that of Wet Meters under various circumstances, but the perfection to which that maker has brought his Meters prevents the possibility of those extravagant errors which are well known to exist where Wet Meters are used."
Particulars and lists of prices forwarded on application to Ranelagh Works, Ranelagh Road, Pimlico, LONDON, S.W.; 15, Market Street, MANCHESTER; or 127, Boulevard de Magenta, PARIS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.
JOHN RUSSELL and CO.,
THE OLD TUBE-WORKS,
CHURCH HILL, WEDNESBURY;
ALMA WORKS,
WALSALL, STAFFORDSHIRE;
and 69, UPPER THAMES STREET, LONDON,

Original Manufacturers of Wrought-Iron Gas-Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam-Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest orders may be executed in a few days.
Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanized Tubes, &c.
N.B.—All goods thoroughly tested before sent out, and warranted.

JOHN BENT & SON,
WET AND DRY GAS-METER
AND
STREET-LAMP
MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
ESTABLISHED 1830.

All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,
NEAR NEWCASTLE-ON-TYNE.

WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.
London Agents: JAMES LAWRIE & CO.,
63, OLD BROAD STREET, CITY, LONDON.

CANNEL COAL FACTORS.
J. & W. ROMANS, of Edinburgh and London, in returning thanks for the confidence hitherto reposed in them, beg to intimate that they have extended their Colliery connexion for the supply of SCOTTISH CANNELS, and have taken a lease of the CROWN WHARF, LIMEHOUSE CUT, LONDON, where these rich Coals can be obtained at the lowest prices.
Messrs. ROMANS, being lessees of several Gas-Works in Scotland, have their Cannels tested in the ordinary working-process-way of gas-making, thus securing for their customers additional guarantee, beyond mere laboratory experiments.
Contracts made to supply any quantity, and analysis sent, on application to the Offices, 53, Frederick Street, EDINBURGH, or 1, Walbrook, Mansion House, LONDON.
Shippers of steam and house Coal, entered on the Government list. Freightage secured on best terms.

LESMAHAGO GAS COAL,
AUCHINHEATH COLLIERY.
LESMAHAGO N.B.

JAMES FERGUSON & CO.
LESSEES SINCE 1832.

LONDON AGENTS:
JAMES LAWRIE & CO.,
63, OLD BROAD STREET, E.C.

CONTINENTAL AGENTS:
LA COUR & WATSON,
LEITH.

GEORGE GLOVER AND CO.,

Patentees of the Standard Gasometers for the Government,

TWO MEDALS,

LONDON, 1862.

HAVE OBTAINED THE

HIGHEST

PRIZE

FOR

SILVER MEDAL,

PARIS, 1867.

IMPROVED DRY GAS-METERS AND GASOMETERS,

AT THE

PARIS EXHIBITION.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.;
AND 127, BOULEVARD DE MAGENTA, PARIS.

JOURNAL OF GAS LIGHTING ONE PENNY NEWSPAPER

HENRY HOWARD & CO.,

COOMBS WOOD PATENT TUBE-WORKS,

OLD HILL, near DUDLEY,

MANUFACTURERS OF

HOWARD'S PATENT IMPROVED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

For Gas, Steam, Water, &c.

SOLE LICENSEES for the United Kingdom for the LAVENANT PATENT ENAMELLED TUBES & FITTINGS,

the Coating of which does not shell off, is a certain preservative from rust, and resists all effects of expansion and contraction.

LAP-WELDED IRON & HOMOGENEOUS METAL TUBES

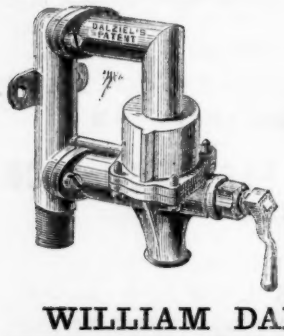
For Locomotive, Marine, and Stationary Boilers.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

WAREHOUSES:

LONDON: No. 157, Upper Thames Street, E.C. LIVERPOOL: No. 63, Paradise Street. MANCHESTER: Barlow's Croft, Chapel Street, Salford. PARIS and LILLE.



IMPORTANT TO WATER COMPANIES, BUILDERS, &c.

DALZIEL'S PATENT

COMBINED COCK AND VALVE,

OR POSITIVE WASTE OF WATER PREVENTER.

Its simplicity, cheapness, strength, durability, and compactness recommend it for every domestic purpose. By its adoption Water Companies will be enabled to give a constant supply to the public, with certainty that no waste can take place.

To be seen daily in operation at 13, Crooked Lane, King William Street, E.C., from Eleven to Twelve.—For price and particulars apply to

WILLIAM DALZIEL, ENGINEER, CREEK ROAD, DEPTFORD, S.E.

E. J. & J. PEARSON,

DELPH & TINTAM ABBEY FIRE-CLAY & BRICK WORKS,

STOURBRIDGE,

PROPRIETORS OF

BEST GLASS-HOUSE POT & CRUCIBLE CLAY;

MANUFACTURERS OF

GLASS-HOUSE POTS, CRUCIBLES, GAS-RETORTS, & FIRE-BRICKS OF EVERY DESCRIPTION.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for **TUBES & FITTINGS.**

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;

GAS-FITTERS TOOLS, VALVES, COCKS, &c

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

IMPROVED CONSUMERS GAS-METERS,

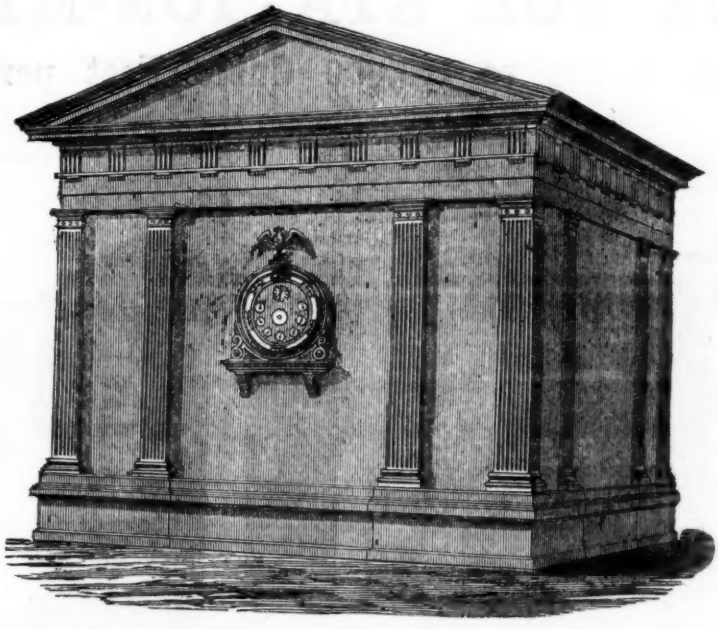
Of the Best Material and Workmanship, carefully adjusted to the requirements of the British Sales of Gas Act and Foreign Standards of Measures.

PATENT COMPENSATING GAS-METERS,

Which are uniform with the Ordinary Meters, and register with minute accuracy.

IMPROVED DRY GAS-METERS,

IN BEST TINNED IRON CASES.



GAS STATION-METERS,

ALL SIZES, WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, EXHAUST-GOVERNORS, &c.

Home and Foreign Orders promptly attended to. Terms, &c., on application.

MESSRS. J. & J. BRADDOCK

Tender their grateful acknowledgments for the past generous and extensive patronage conferred on their firm, and beg to assure their Friends, Gas Engineers, and Gas Companies generally, that every exertion will continue to be made to maintain the sterling quality of their work in every department.

Their ORDINARY METERS, WET and DRY, have now a demand over that of any other maker in the North of England; and their STATION-METERS stand unrivalled for Design, Sound Workmanship, and Efficiency.

All sizes of CONSUMERS METERS generally in Stock.

STATION-METERS, in round or square cases, on the Shortest Notice.

D. BRUCE PEEBLES & CO.,

ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,

BRASSFOUNDERS, & GAS APPARATUS MANUFACTURERS,

FOUNTAINBRIDGE WORKS, EDINBURGH.

SOLE MANUFACTURERS OF

Peebles' Patent Wet and Dry Gas-Meters in Tin-Plate Cases, with Tongue and Groove Joints.

IMPROVED WET METERS IN CAST-IRON CASES.

STATION-METERS, GOVERNORS, EXPERIMENTING METERS, PHOTOMETERS, PRESSURE-GAUGES, &c.

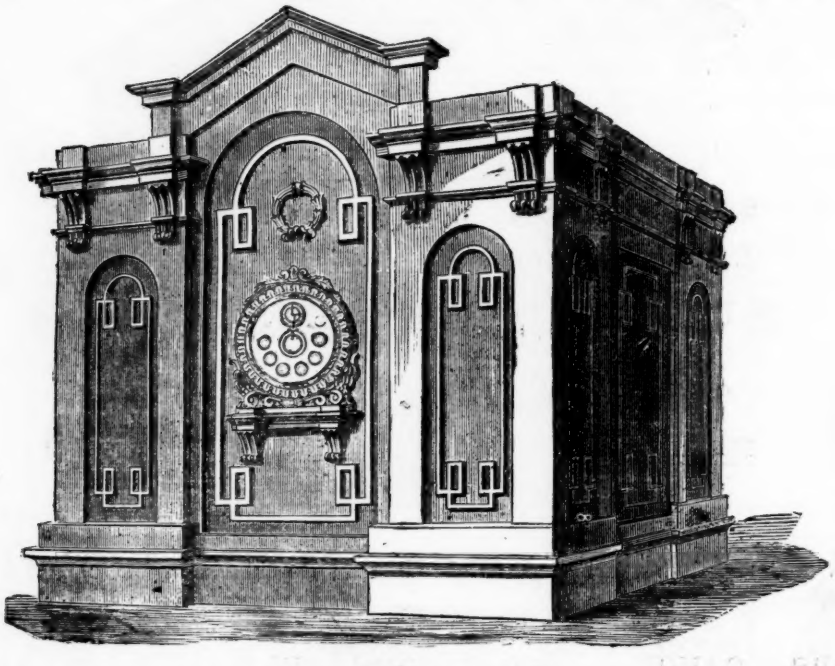
GAS AND WATER PIPES.

CLARIDGE, NORTH, & CO.,

BILSTON.

DESIGN FOR STATION-METERS,

From 45,000 to 120,000 Cubic Feet per Hour.



MANUFACTURED BY THE

GAS-METER COMPANY,

LIMITED,

LATE WEST & GREGSON, OLDHAM.

Meters of a similar design may be seen in operation in London, Manchester, Liverpool, Dublin, Oldham, Leeds, Bristol, Halifax, Salford, Stockport, Wolverhampton, Rochdale, Bradford, Bolton, Blackburn, and many other places.

Just Published, demy 8vo, half bound roan, cloth sides, lettered, price 7s. 6d., by post 8s.,

THE GAS MANAGER'S HANDBOOK,

CONSISTING OF

TABLES, RULES, AND USEFUL INFORMATION

FOR

GAS ENGINEERS, MANAGERS,

AND OTHERS ENGAGED IN THE

MANUFACTURE AND DISTRIBUTION OF COAL GAS.

By THOMAS NEWBIGGING A.I.C.E.

"An extremely useful compilation has been made by Mr. T. Newbigging, late of Bacup, under the title of 'The Gas Manager's Handbook.' It contains an immense amount of information, of a practical character, on all matters which concern gas managers, and forms an admirable work of reference, which will no doubt find a place in every gas office."—*Journal of Gas Lighting.*

"Within the moderate compass of about 160 pages, the author—or perhaps we should more appropriately say the editor of this Handbook has contrived to pack, without crowding—and without confusion or ambiguity, almost all the information which any gas engineer or manager could desire in a book of reference such as this professes to be."—*Colliery Guardian.*

"This volume is an exhaustive cyclopædia of the literature of gas lighting. The author has laid his hands on everything good that already existed, in the way of tables and statistics, and has embodied the whole, with many additions, in the form of a volume, the want of which has been long felt by gas engineers and managers. An interesting chronology of gas lighting is appended to the book."—*English Mechanic.*

"Considering the important position which the manufacture of gas has occupied for some years past amongst the industries of this and other civilized countries, we can only wonder that an earlier attempt has not been made to supply to gas engineers and managers a handbook such as that now before us. That there has been a want of such a work can scarcely be doubted, and although Mr. Newbigging's book is not free from defects, we feel sure that it will be accepted as a useful companion by those for whose employment it was compiled."—*Engineering.*

"The class of books to which the one we notice belongs is among the most useful that issues from the press; and this one, from the variety and amount of information it contains, may be fairly described as one of the most useful of its class. It is a book which will be thoroughly appreciated by those who until now have had to seek in a dozen volumes for the information here collected into one, and who have had to spend hours in making calculations here done to their hands."—*Mechanics' Magazine.*

"C'est un recueil de toutes les données, de tous les calculs, de toutes les formules, de toutes les recettes dont on peut avoir besoin dans la construction et dans la direction de l'exploitation d'une usine à gaz. Rendement des charbons, conduites des fours, épuration, vérification de la qualité du gaz, montage des appareils, ciments, pose des conduites, service d'éclairage public et particulier, travail intérieur d'usine, surveillance, comptabilité, tout s'y trouve, jusqu'à une table chronologique des faits de l'histoire de l'éclairage au gaz; en un mot, l'auteur n'a rien oublié de ce qui peut rendre son livre utile, indispensable, curieux. Nous engageons ceux de nos lecteurs auxquels la langue anglaise est familière à acquérir cet ouvrage; ils y trouveront des indications précieuses."—*Le Gaz*, May 15, 1870.

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

TO GAS COMPANIES.

Just Published,

THE METER LIFE BOOK;

OR REGISTER AND STOCK-BOOK COMBINED.

A clear, concise, and easy method of keeping a Register or History of any number of Meters.

By ROBERT PEAKE KEYS, ACCOUNTANT and GENERAL AGENT,

26, BUDGE ROW, CANNON STREET,

OVER THE KENT FIRE OFFICES.

(Late of the Firm of Hight & Keys, Accountants & Auditors.)

Specimen Sheets forwarded on receipt of 2s. 6d.

HAMILTON WOODS AND CO.,

LIVER FOUNDRY, SALFORD,

MANUFACTURERS OF

SLUICE-VALVES & HYDRANTS,

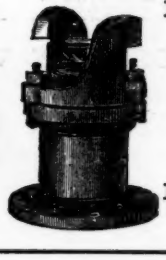
As supplied to Water-Works and Local Boards.

SLUICE-VALVES, from 14s. per inch,

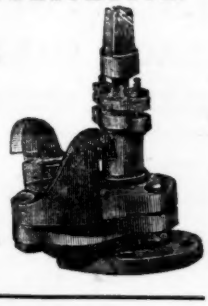
Tight on both Faces, and fitted with Gun-Metal Valve Faces and Seats, and Screws and Nuts.

Every Valve proved to 200 lbs. per square inch.

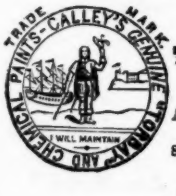
PRICE LISTS ON APPLICATION.



HYDRANTS,
WITH
Gun-Metal Screws,
Valves, and Nuts,
18s. each.



BALL
HYDRANTS,
84s. per doz.



CALLEY'S

Genuine

TORBAY AND CHEMICAL PAINTS

Are Durable, Economical, and keep their Colours.

Awarded Honourable Mention at the Dublin Exhibition, 1865, and Prize Medal at the Paris Exposition, 1867.

See "The Record of Engineering," 1864; "The Journal of the Society of Arts," June 1, 1866; "The Mechanics' Magazine," Oct. 26, 1866; "The Engineer," Nov. 2, 1866.

WORKS: NEW ROAD, BRIXHAM, TORBAY, DEVON.

HARRIS AND PEARSON,

STOURBRIDGE.

PROPRIETORS OF

BEST GLASS-HOUSE POT & CRUCIBLE CLAY.

MANUFACTURERS OF

FIRE-BRICKS, GAS-RETORTS, AND FIRE-CLAY GOODS

OF EVERY DESCRIPTION.

Orders of any magnitude, for home and exportation executed with all possible despatch.

N.B.—A quantity of Retorts in stock.

Circulars, 15 in. and 16 in. Ovals, 20 in. by 14 in.

D's, 15×13, 16×12, 18×14, 20×16, 21×14, 24×14.

ALFRED PENNY, Gas and Consulting ENGINEER,

WENLOCK IRON-WORKS,

21, WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, and T-pieces, &c., &c.

Plans, Specifications, and Estimates prepared.

D. GRANT & CO.,

GAS-METER MANUFACTURERS.

STATION-METERS ANY SIZE,

PHOTOMETERS, EXPERIMENTAL METERS, &c.

GAS-METER WORKS, CROSSCAUSEWAY, EDINBURGH.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

EDGE'S Patent for Removing the CARBONACEOUS INCRUSTATION from GAS-RETORTS.

For particulars and terms, apply to E. GODDARD, Sole Agent, Gas-Works, IPSWICH.

CATHELS'S Patent Ribbed Gas Main-PIPES cost but about 1d. to 2d. per yard (depending on the size) more than Plain Pipes, and ensure PERFECT GAS-TIGHT CONNEXIONS with the Service-Pipes.

Apply to Messrs. BEGGS & SON, 37, Southampton Street, Strand, LONDON.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

OXIDE OF IRON.—

We are prepared to supply, on moderate terms,

HYDRATED PEROXIDE OF IRON (BOG OCHRE),

Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

FRANCIS RITCHIE & SONS,

BELFAST.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire-Bricks, and every description of Fire-Clay Goods.

TROTTER, HAINES, & CORBETT,

BRETTELL'S ESTATE

FIRE CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICK.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to

E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

CHARLES HORSLEY, Agent.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

Analyses by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

Description.	Cubic Feet of Gas per Ton of Coals.	Illuminating Power in Candles.	Coke per Ton of Coal used. Cwt.	Ash in Coke per Cent.	Sulphur in Coal per Cent.
Best Silkstone . .	10,900	17·0	12·8	2·6	1·7
Norfolk Silkstone . .	11,000	15·94	12·5	4·4	1·64
Silkstone Brights . .	11,500	14·5	12·6	7·4	1·85
Silkstone Nuts . . .	10,800	15·85	12·66	6·0	0·69

NOTE.—The illuminating power of the Gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

OFFICES, 34, LONDON WALL, CITY, E.C.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM,

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

CAST AND WROUGHT IRON GIRDERS, BRIDGES, AND ROOFS,

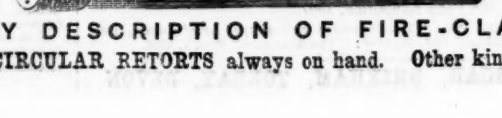
STEAM-ENGINE BOILERS, & GENERAL WROUGHT-IRON WORK.

London Agents: PORTER and LANE, 172, FENCHURCH STREET, E.C.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,



AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

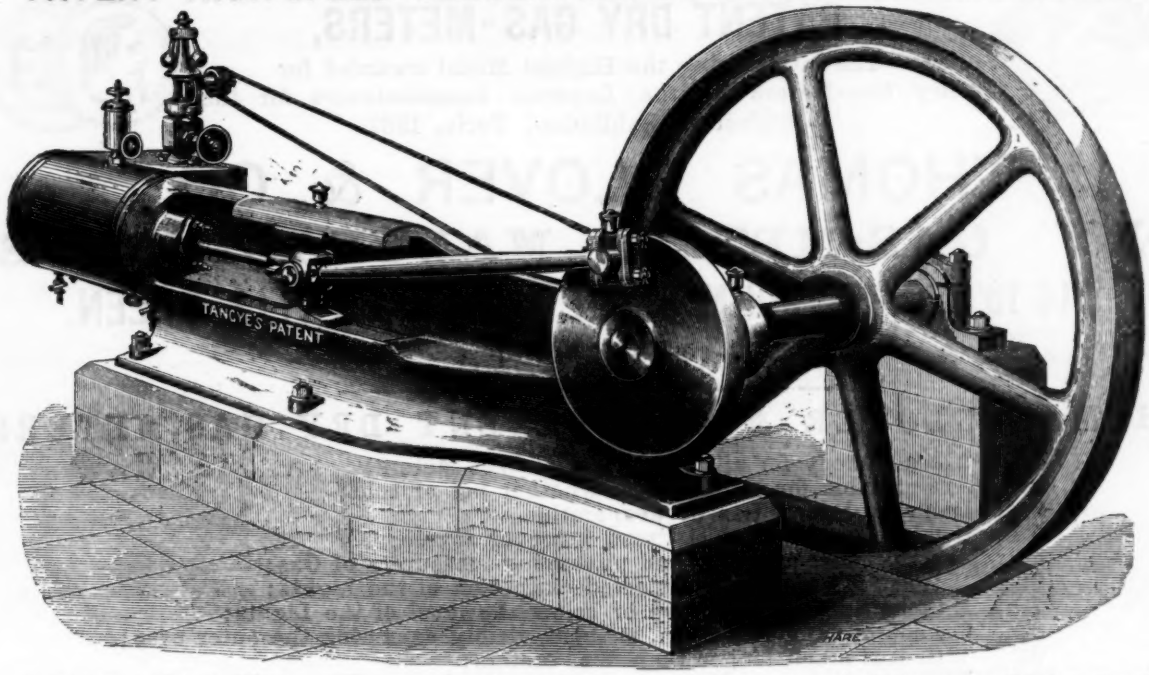
TANGYE BROTHERS & HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.;

And BIRMINGHAM (TANGYE BROS.), CORNWALL WORKS, SOHO.

TANGYE'S

PATENT HIGH-SPEED REGULATING GOVERNOR STEAM-ENGINE.



In this Engine the working parts are considerably reduced in number as compared with Horizontal Engines generally, rendering it far more durable and compact. The bed-plate, front cylinder cover, guides, and plummer-block for crank-shaft bearing are formed of one piece of metal, which in design and proportions is admitted by competent engineers to be perfect, and to afford a strength and rigidity that cannot possibly be attained with the best-fitted Engines of the ordinary horizontal type. The crosshead blocks and all the bearings are adjustable, so that any wear can be readily taken up. The material and workmanship are of the highest class throughout,

The Governor is of a very special description, and combines in the small space usually occupied by the ordinary Steam Stop-valve, a Governor, Throttle-valve, and Stop-valve complete. It is exceedingly sensitive, simple, and compact.

PRICES AND PARTICULARS.

NOMINAL HORSE POWER	ONE	TWO	THREE	FOUR	SIX	EIGHT	TEN	TWELVE
Diameter of Steam Cylinder	3 in.	4 in.	5 in.	6 in.	8 in.	9 in.	10 in.	12 in.
Length of Stroke	6 in.	8 in.	10 in.	12 in.	16 in.	18 in.	20 in.	24 in.
Price of Engine, with Governor and Feed Pump	**£20**	**£27 10**	**£35**	**£45**	**£60**	**£80**	**£100**	**£120**
Price of Engine and Boiler, with Fittings	£43	£56 0	£84	£100	£135	£168	£205	£235

THE "SPECIAL" STEAM-PUMP.

For Pumping Ammoniacal Liquor, Tar, and Water in Gas-Works.

OVER 1000 IN USE.

NOTE.

Each one is carefully tested with Steam and Water before leaving the Manufactory.

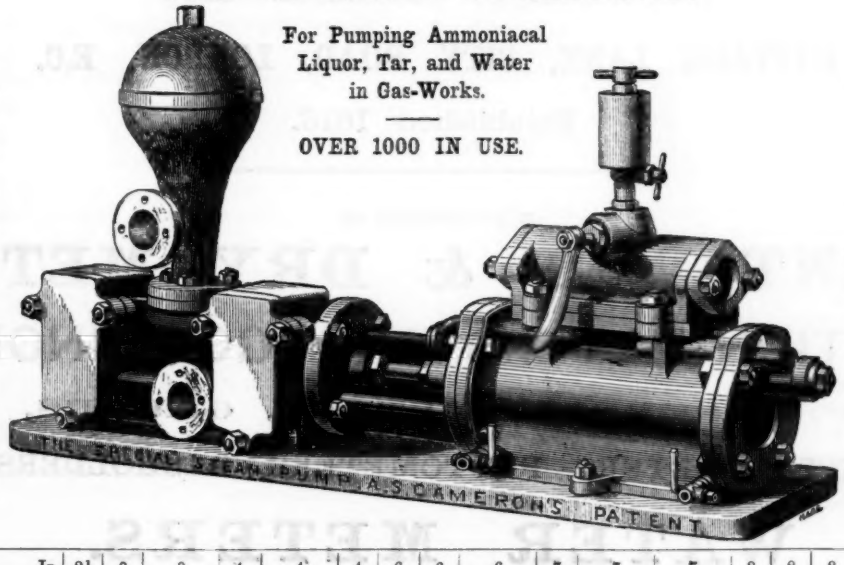
In case of special quotations, the following particulars are required, viz.—

Pressure of Steam in Boiler.

The number of gallons required to be lifted in a given time.

And the height of Lift from level of water to the point of delivery.

In ordering, state the purpose for which the Pump is required, to ensure suitable valves being sent.



NOTE.

Requires NO Shafting, Gearing, Riggers, or Belts.

All Double Acting.

Works at any Speed, and any pressure of steam.

Will force to any height.

Delivers a constant stream.

Can be placed at any distance away from a boiler.

Occupies little space.

Simple, Durable, Economical.

Diameter of Steam Cylinder	In.	2¼	3	3	4	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12
Diameter of Water Cylinder	In.	1¼	1½	3	2	3	4	3	4	6	5	6	7	4	6	7	8	6	7	8
PRICE		**£10**	**£15**	**£22 10**	**£20**	**£27 10**	**£35**	**£30**	**£40**	**£47 10**	**£50**	**£52 10**	**£57 10**	**£50**	**£55**	**£65**	**£85**	**£70**	**£80**	**£100**

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

CONTENTS.

Notes upon Passing Events:— PAGE

War Notes 677
The Prussian Artillery 677
The Royal Engineers and the Telegraphs 677
French Peasantry 677
Third Report of the Commissioners on the Employment of Young Persons and Women in Wales 678
Railways in the Brazils 679

Circular to Gas Companies:—

Public Lighting in Dublin 680
First Report of the Glasgow Corporation Gas Committee 680
Transfer of the Leeds Gas-Works to the Corporation 680
Gas Affairs at Sheerness 680
The Siege of Paris 680
Suggested Use of Gas as a Defensive Agent 680
Hill's Process for Desulphurizing Gas Liquor 680
Key's Meter Life Book 680

Parliamentary Intelligence:—

House of Lords Committee—Blackburn Corporation Improvement Bill . 681

Miscellaneous News:—

Meeting of the Mauritius Gas Company 686
Glasgow Town Council 687
North British Association of Gas Managers 689
Dr. Frankland's Analysis of the Metropolitan Waters, in August . . . 691
The Corporation of Leeds and the Gas Companies 691
The late Mr. James Sharp 692

Register of New Patents:—

Applications for Letters Patent 692
Grants of Provisional Protection 692
Notices to Proceed 692

Gas Share List 693

Price Current 693

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

NOTICES.

The subscription to the JOURNAL is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders should be made payable at the Money-Order Office, London, to William B. King, 11, Bolt Court, Fleet Street, by whom the business department of the JOURNAL is conducted.

SCALE OF CHARGES FOR ADVERTISEMENTS.

Six lines and under . . . . . 3s. 0d.

Sixpence per line for every line additional.

Special contract for advertisements intended for continuous insertion.

This JOURNAL has been duly registered at the General Post-Office for transmission abroad.

All communications for the Editor to be addressed, "No. 42, Parliament Street, Westminster;" and all remittances for subscriptions or orders for advertisements to the Publisher, No. 11, Bolt Court, Fleet Street.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 13, 1870.

Notes upon Passing Events.

THE unvarying overpowering victories of the Prussians have, amongst other military questions, called attention to the respective value of the artillery of the conquering and defeated armies. Before the war, the military critic of the *Times* informed us that the Prussian artillery was in every respect inferior to the French. The result has been the other way, but that result may arise from many causes, independent of the mechanical value of the guns of the two armies. A few days ago, the *Times* came out with one of its slashing leaders, in which it assumed that the case lay between breech-loaders and muzzle-loaders—a flagrant example of the "*post hoc, propter hoc*" fallacy. According to the reports of the admirable military correspondents of the various papers—reports quite unequalled in their way—the Prussians had more guns, better placed, better driven, and better served and aimed. At present there is not an atom of proof that breech-loading had anything to do with the "crushing Prussian fire." On the contrary, we are told that the Prussian gunners were rather slow, but very accurate. Now, rapidity is the special merit of breech-loading artillery. We gave a good trial to breech-loading field-guns in China, and the opinion of both master gunners and officers is against the principle, because so often failing in action. That opinion is also held by our first civil mechanics, who are familiar with every contrivance for opening and closing the breech of big guns. The subject is not, therefore, one to be settled off-hand, but rather for careful investigation by the light of the campaign now in progress. Before the International Exhibition of 1851, our manufacturers knew very little about the manufacture of good iron or steel; a century of progress has since been made by the school of which Bessemer is the leading figure. We have wealth in mechanical genius, in mechanics, and raw material. We ought to have the best guns in the world, our gunners and drivers—at least what there are of them—are second to none.

We note that the repairs of the metropolitan telegraph wires are being executed by the Royal Engineers. The idea is, no doubt, twofold—to render the Engineers capable of constructing telegraphs abroad and at home, in war as well as in peace, and to save the Post-Office money in the wages of labour. If the latter is a consideration, the sooner the Royal Engineers are provided with a fatigue-dress, suitable for dirty work, instead of their second best uniforms, the better for the cause of economy. A scarlet jacket, blue over-alls, with a yellow stripe, cut in English soldierly fashion—that is tight—are about the very last selection a first-class navvy would make for a job of digging. A working man's dress should be at any rate loose at the knees and breech; probably flannel knickerbockers, with gaiters to be worn on march, would be as useful as anything, of any colour, or with any stripe. We do not contemplate making Engineers look like civilian mechanics, but only removing the impediments to real work. Nothing can be more sensible in cut than the baggy trousers and gaiters of a French infantry soldier. There is another point of military costume which demands attention. For many years—at any rate since the Crimean War—flannel shirts have been the universal wear of our sportsmen, boatmen, and athletes generally, and particularly of all travellers on pedestrian excursions. Flannel is cheaper in England than any other country; it is one of our manufacturing specialities. Whenever common sense prevails at the tailoring department of the Horse Guards, flannel shirts will supersede cotton in all the divisions of the army, but especially in the Engineers, now that they are required to work so much in their shirts in London streets. Returning to telegraphs, it is a pity that the director of that department cannot find something for the army of fine boys who are now being totally ruined by compulsory idleness. At every suburban post-office telegraph you may see two or more boys, in uniform, waiting all day for the few-and-far-between messages. They are not under the control of the postmaster, be he grocer or stationer, except on telegraphic business. What is to become of these boys, who are learning habits of indolence at the most critical period of their lives? Colonel Du Platt's drill is all very well in its way, but that takes place only once or twice a week. Then boys cannot all grow tall, handsome, and fit for footmen of the gorgeous ornamental department. The subject is worth the attention of some of the floating philanthropists anxious for new amateur employment.

The stock notions of the combination of Arcadian simplicity and polite intelligence of the French peasant proprietors—a class whom such different geniuses as Mr. John Stuart Mill and Mr. Matthew Arnold are never tired of praising—have not been borne out by the annals of the Prussian invasion. Equality and compulsory division of land, with a very costly system of official education, have apparently produced a race quite as ignorant as our agricultural labourers, and much more savage. Here the peasantry—not town roughs or colliers, but simple peasants—burn a gentleman alive for wearing a good coat; there they ferociously hunt every suspected foreigner as a Prussian spy, while on the battle-field peasant women murder and malignantly maim the wounded. How our people would behave under the same circumstances it is impossible to say. We should not like to trust a solitary or wounded invading Frenchman in a village of Staffordshire colliers, but we are constantly told by the romantic philosophers that if we will only abolish landed squires, and give every peasant his ten acres, a millennium of contented intelligence will swiftly follow. At any rate the example of France is not encouraging. There the peasantry, who with so much reason hated the aristocrats and landowners in 1792, seem equally to hate, without any reason, any one who speaks civilized French and does not wear *sabots*. At the same time there is a lesson for us to learn in the barbarism of French peasants. We cannot afford to let our agricultural labourers remain in their present ignorant and often hopeless condition. Professor Huxley says some good things on the education of the agricultural labourer in his "Lay Sermons":—

> In primary schools a child learns—
> 1. To read, write, and cipher, more or less well; but in a very large proportion of cases not so well as to take pleasure in reading, or to be able to write the commonest letter properly.

2. A quantity of dogmatic theology, of which the child, nine times out of ten, understands next to nothing.

3. Mixed up with this, so as to seem to stand or fall with it, a few of the broadest and simplest principles of morality. This, to my mind, is much as if a man of science should make the story of the fall of the apple in Newton's garden an integral part of the doctrine of gravitation, and teach it as of equal authority with the law of the inverse squares.

4. A good deal of Jewish history and Syrian geography, and, perhaps, a little something about English history and the geography of the child's own country. But I doubt if there *is a primary school in England in which hangs a map of the hundred in which the village lies*, so that the children may be practically taught by it what a map means.

5. A certain amount of regularity, attentive obedience, respect for others—obtained by fear, if the master be incompetent or foolish; by love and reverence, if he be wise.

So far as this school course embraces a training in the theory and practice of obedience to the moral laws of nature, I gladly admit, not only that it contains a valuable educational element, but that, so far, it deals with the most valuable and important part of all education. Yet contrast what is done in this direction with what might be done, with the time given to matters of comparatively no importance, with the absence of any attention to things of the highest moment, and one is tempted to think of Falstaff's bill and "the halfpenny worth of bread to all that quantity of sack." . . .

Again, the child learns absolutely nothing of the history or the political organization of his own country. His general impression is, that everything of much importance happened a very long while ago; and that the Queen and the gentlefolks govern the country much after the fashion of King David and the elders and nobles of Israel—his sole models. Will you give a man with this much information a vote? In easy times he sells it for a pot of beer. Why should he not? It is of about as much use to him as a chignon, and he knows as much what to do with it for any other purpose. In bad times, on the contrary, he applies his simple theory of government, and believes that his rulers are the cause of his sufferings—a belief which sometimes bears remarkable practical fruits. . . .

What wonder, then, if very recently an appeal has been made to statistics for the profoundly foolish purpose of showing that education is of no good—that it diminishes neither misery nor crime among the masses of mankind? I reply, why should the thing which has been called education do either the one or the other? If I am a knave or a fool, teaching me to read and write will not make me less of either one or the other—unless somebody shows me how to put my reading and writing to wise and good purposes.

Suppose any one were to argue that medicine is of no use because it could be proved statistically that the per centage of deaths was just the same among people who had been taught how to open a medicine-chest and among those who did not so much as know the key by sight. The argument is absurd; but it is not more preposterous than that against which I am contending. The only medicine for suffering, crime, and all the other woes of mankind, is wisdom. Teach a man to read and write, and you have put into his hands the great keys of the wisdom-box. But it is quite another matter whether he ever opens the box or not. And he is as likely to poison as to cure himself, if, without guidance, he swallows the first drug that comes to hand. In these times a man may as well be purblind as unable to read—lame as unable to write. But I protest that, if I thought the alternative were a necessary one, I would rather that the children of the poor should grow up ignorant of both these mighty arts, than that they should remain ignorant of that knowledge to which these arts are means.

I conceive the proper course to be somewhat as follows. To begin with, let every child be instructed in those general views of the phenomena of nature for which we have no exact English name. The nearest approximation to a name for what I mean which we possess is "physical geography." The Germans have a better, "Erdkunde" ("earth knowledge," or "geology" in its etymological sense)—that is to say, a general knowledge of the earth, and what is on it, in it, and about it. If any one who has had experience of the ways of young children will call to mind their questions, he will find that so far as they can be put into any scientific category they come under this head of "Erdkunde." The child asks, "What is the moon, and why does it shine?" "What is this water, and where does it run?" "What is the wind?" "What makes the waves in the sea?" "Where does this animal live, and what is the use of that plant?" And if not snubbed and stunted by being told not to ask foolish questions, there is no limit to the intellectual craving of a young child, nor any bounds to the slow but solid accretion of knowledge and development of the thinking faculty in this way. To all such questions, answers which are necessarily incomplete, though true as far as they go, may be given by any teacher whose ideas represent real knowledge and not mere book-learning, and a panoramic view of nature, accompanied by a strong infusion of the scientific habit of mind, may thus be placed within the reach of every child of nine or ten.

After this preliminary opening of the eyes to the great spectacle of the daily progress of nature, as the reasoning faculties of the child grow, and he becomes familiar with the use of the tools of knowledge—reading, writing, and elementary mathematics—he should pass on to what is, in the more strict sense, physical science. Now there are two kinds of physical science—the one regards form, and the relation of forms to one another; the other deals with causes and effects. In many of what we term our sciences these two kinds are mixed up together; but systematic botany is a pure example of the former kind, and physics of the latter kind, of science. Every educational advantage which training in physical science can give is obtainable from the proper study of these two; and I should be contented, for the present, if they, added to our "Erdkunde," furnished the whole of the scientific curriculum of schools. Indeed, I conceive it would be one of the greatest boons which could be conferred upon England, if henceforth every child in the country were instructed in the general knowledge of the things about it, in the elements of physics and of botany. But I should be still better pleased if there could be added somewhat of chemistry, and an elementary acquaintance with human physiology.

So far as school education is concerned, I want to go no farther just now; and I believe that such instruction would make an excellent introduction to that preparatory scientific training which, as I have indicated, is so essential for the successful pursuit of our most important professions. But this modicum of instruction must be so given as to ensure real knowledge and practical discipline. If scientific education is to be dealt with as mere bookwork, it will be better not to attempt it, but to stick to the Latin Grammar, which makes no pretence to be anything but bookwork.

The third report of the Commissioners on the Employment of Young Persons and Women in Agriculture treats of Wales. There we find striking examples of favourable conditions of existence not made the best of for want of intelligent education. The Welsh, unlike the Irish, are naturally thrifty, and yet inclined to profitable investment. The land difficulty does not usually exist in Wales. Labourers can generally secure with their cottage a good garden and a cow's grass or feed for a small flock of sheep on a mountain. Railroads, and the increase of iron and other works, especially in South Wales, have greatly raised the rate of wages and the value of all agricultural produce. Wherever anything like sea-bathing can be obtained, even on such a sandy waste as Rhyll, the native inhabitants enjoy the profits of the annual visits and expenditure of the Saxon. But unfortunately a very large per centage of the Welsh speak only their own—we will not say barbarous, but bookless—language. In religion the masses dissent from the creed of the gentry, which, considering the character of a great many of the Welsh clergy of the last and even the present generation, is not surprising. The consequence too frequently is that a schoolmaster speaking only English, under the patronage and control of a Church of England parson, is only the means for the instruction of a large parish of Welsh-speaking Calvinistic Dissenters. The future political dangers of such a condition of education are obvious. Fortunately the Welsh are a mild-tempered, commercial-minded people; and, although they hate the Saxon, they never strive to murder or maim him; they are content with cheating him or overcharging him on every convenient opportunity. Under our new education law the object of the wealthier classes should be to force the Welsh children to learn English. In this task cheap newspapers are a great incentive. At this moment hundreds—perhaps thousands—of Welsh-speaking parents call on their children to translate to them from a penny or a halfpenny newspaper the news of the war. A Minister of Education would, if wise, encourage the study of modern English history and geography for the Welsh. Every Welsh—indeed, every English national school should have at least three maps—viz., an Ordnance map, making the schoolhouse the centre, and extending, say, twenty miles round, such as Mr. Stanford, of Charing Cross, compounds for hunting country gentlemen; a map of Great Britain, and a map of the world. Thus they would learn the meaning of geography and the dimensions of Wales. The history of England should commence in 1815. The story of Cæsar's invasion of Britain might be left for a later period. But it is essential that the masters teaching Welsh schools in English should be Welshmen, or at any rate perfectly familiar with colloquial Welsh. The report of the commissioners is that wages vary from 12s. to 18s. in Wales, with cottages and gardens at low rates. Small freeholds are numerous, and tenancies on long leases at nominal rents still more numerous. Gang labour is unknown, and the field labour of women and children not carried to a mischievous extent. The cottages, except where they are on the property of Anglified landowners like Sir W. W. Wynn, are usually constructed in defiance of all the laws of health and common decency. No improvement can be expected except from the education of the rising generation in unsectarian schools. As a rule, a frightful feud prevails between the parson of the parish and Dissenting ministers with much larger congregations than the parson's. Small farmers are an industrious race, and breed a race of industrious children, who in Wales generally enjoy the inestimable advantage of pure milk, in ample quantities, to counteract their filthy cottages. They are at present disinclined to spare their children from labour for school, but that is not surprising when we find how little really useful knowledge is imparted. To destroy those small freehold or tenant farmers, if it were possible, would be a great mistake; but if there were no landed gentry of a higher rank, the cause of education and cottage improvement would have no advocates or subscribers. The small Welsh squires are nearly as bigoted and opposed to Saxon improvements as the mere peasantry. On the whole, the Welsh peasantry have brighter prospects in their own hands than the English agricultural labourer of the purely agricultural districts. It is odd at this day to find a candidate for such a constituency as Mid Surrey advocating the creation of a district of spade labourers. If he had said gardeners, near a market, he might have been understood; but to return to the spade now, for purely agricultural produce, would be like returning to the spinning-wheel from the spinning-jenny. Much more embarrassing are the reports of the Poor Law Inspectors on the wages of agricultural labour in Ireland. These reports alone account for the chronic discontent of the cleverest, the most amusing, the most unteachable people in the world. In Ireland there are no great manufacturing districts like these which have revolutionized the character of North and South Wales. Land is dear, landlords are poor, and the failure of the potato has deprived the people of the refuse on which, by feeding pigs and poultry, they supplemented their wretched wages. Wages have risen, but not sufficiently in proportion to price of food to keep in decent comfort families which now have to purchase every article of necessity; while the peasant farmers are almost entirely wanting in those habits of cleanliness, neatness, and industry which enable the Swiss, the Flemish, and the Dutch to turn dairying to so good an account. With soil and climate admirably adapted for producing milk, the butter of Ireland is of a very low class, and no cheese is manufactured, yet for butter and cheese there is an unlimited demand. The gold discoveries have raised the price of the necessaries of life. In Cork, Limerick, and Waterford, where there are important seaports, and some

manufactures, wages vary from 7s. to 10s. a week. At these rates employment is not constant, and high rents are paid for miserable cabins—mere hovels. In the northern counties of Antrim, part of Armagh, Down, Londonderry, and Tyrone, labourers get from 1s. 8d. to 2s. per day—ploughmen more. In this district only does a commissioner report content. In County Dublin, Wicklow, Carlow, Kildare, and Meath, discontent accompanies wages of 7s. 6d. per week without a cottage, and 6s. 6d. with one. Those who work for and live on large farms are comparatively well off; not so with a large proportion of the labouring population. *In spring* and harvest the demand for labour surpasses the supply, and high wages may be earned, but in winter work is scarce. Most of the houses are of the worst description, often far from work. There is a "*universal desire* "*on the part of labourers to procure houses on the land of their* "*employers, with land enough to grow vegetables.*" This arrangement is likely to become every year more general, for farmers find that it is only by that means they can secure labour all the year round. The same tale is told from every county, and thus discontent is the natural condition of affairs in Ireland. How can any nation be content miserably lodged, miserably paid, and not regularly employed? A table of comparative prices of provisions in 1850 and 1870 rather puzzles us. If the other items are like those of tea and sugar, the guardians have liberal ideas. Think of tea at 2s. 10d. per lb., bought wholesale; excellent tea may be had for from 1s. 6d. to 1s. 9d. The most hopeful reporter says: "The labouring classes have been so reduced in numbers "that, if they were properly housed and located in the country, "I do not believe there would be want of employment at any "season of the year in my district." The present is Ireland's chance. If recent legislation produces peace and content, English capital, driven from the Continent, will flow to Ireland. But the press of Ireland of every shade of politics lives on agitation and irritation.

Mr. Daniel Fox's paper on the Sao Paulo Railway, Brazil, read at the beginning of the year, before the Institution of Civil Engineers, contains points of interest to even the unprofessional reader. The Sao Paulo Railway was not constructed on the text of "expense no object." The engineers had to execute the work for a fixed sum, or leave it alone; and, although the circumstances were so novel as to make estimates almost impossible, they succeeded. Had the line not been conceded on special conditions as to capital, it would certainly have been needlessly perfect, and cost half as much again. Fortunately there were no official Brazilian engineers to interfere with the plans of the English engineers, Mr. Brunlees, and his able assistants. The concession was granted in April, 1856, for a line of railway commencing at Santos, passing close by the city of Sao Paulo, and terminating at the town of Jundiah—a distance of about 88 miles—with a guarantee of 7 per cent. interest on a capital of £2,000,000 for 99 years. Mr. Fox was sent out by Mr. Brunlees to undertake the preliminary surveys. "The undertaking involved the con- "struction of a first-class railway up the precipitous side of the "escarpment called the Serra do Mar, which runs parallel to the "sea-coast in a direction at right angles to that of the railway, "and which rises abruptly to a minimum height of 2500 feet above "the sea level." To overcome this obstruction by tunnelling would have required a continuous incline 26 miles in length, at a cost of at least a million and a half, or three-fourths of the whole guaranteed capital. Mr. Brunlees therefore decided on and executed a series of inclined planes with a gradient of one in ten, worked by stationary engines. The difficulties of the work were enormous. The whole escarpment, from the deepest gorge to the highest peak, is covered by primeval forests, through which the surveyor was obliged to drive narrow paths resembling headings. "The exploring party usually remained in the jungle "three weeks at a time, living in huts covered with the leaves "of the palmetto, exposed to tropical rains and other hardships. "They emerged from the woods blanched from want of sunlight, "which rarely penetrates the gloom of a Brazilian forest." The first sod was turned in 1860; the rails were laid in July, 1866; and the line opened for traffic in February, 1867. The line has been worked ever since with most satisfactory results, both as regards receipts and working expenses, and had the rate of exchange been at par, the traffic during the half year ending June 30, 1869, would have been sufficient to pay the full dividend of £7 cent., without the assistance of the Brazilian Government. Santos, on an island rising out of a mangrove marsh, is the seaport, and only seaport, on a coast of 300 miles, and therefore must eventually be a place of great importance. Sao Paulo, the capital of the province, and the largest island town of the empire, is situated on the line of the railway about 48 miles from Santos. The cultivation of coffee in this province was only introduced in 1840. There are now 30 million trees, producing 80 billion pounds of coffee every year, and new plantations are continually being made. If peace be preserved, the next tax repealed or reduced by our Chancellor of the Exchequer will be that on coffee. Other tropical products—such as cotton, sugar, tobacco, rice, Indian corn, arrowroot, and indigo—are produced, as well as cereals and fruits of Central Europe. Cotton seems likely to rival coffee in importance. The Sao Paulo Railway has been constructed on the model of good European railways, the works being of a substantial and durable character, capable of serving the traffic of the entire province. The only railway materials obtainable in the province are timber, stone, bricks, lime, and ballast. From want of knowledge even amongst the Brazilian officials, at present Brazilian timber can only be used with doubt, some being excellent, others recommended to the engineers turned out worthless. Imported pitch pine is found more economical for certain purposes, because so much more easily wrought than the hard native woods. Good building stone is scarce. All the old buildings of Sao Paulo are constructed of *pisé*, or rammed earth; but bricks are coming into extensive use. Several of Clayton's brick-making machines are at work in the province. The natives do not understand brickwork. The stations have been built by English, German, and Portuguese workmen. The present price for good bricks is about three pounds a thousand. The author's experience is wholly against corrugated iron as a roofing for railway buildings, on the ground of expense, destructibility, great heat, and the difficulty of making it water-tight. Nothing is so good, where ventilation is important, as the ordinary Portuguese tile of the country. All the ironwork, before leaving England, was immersed, while hot, in a composition of coal tar and asphalte, by means of which rust was prevented. After erection it was again paid over with coal tar—the best preservative of ironwork in hot countries. The cast-iron piles, in salt water, are covered with oysters to a considerable thickness, so firmly adhering to the pile that air and water are alike excluded. The haulage of materials is amongst the items that increase the cost of railway construction in such a country. In May, 1861, Mr. Fox met, floundering in the mud, a bullock-cart, with eight oxen and three men, transporting a smith's bellows and tools a distance of under 20 miles! About 2600 tons of permanent way materials, with a small contractor's locomotive, conveyed from the foot of the Serra by the public road, 24 miles, cost £11,000! As to labour, the hardest workers, the most numerous, and the most disorderly were the Portuguese and natives of the Western Isles. The Germans were the steadiest. The native Brazilian is indisposed to work; the existence of slavery has engendered false pride; besides, he can live so easily in his simple way. The incentive of good wages regularly paid soon induced numbers to leave their cabins and little plantations of bananas, beans, and Indian corn, but they always returned home at the planting season. They are a tractable race, and easily managed with ordinary tact, appreciating considerate treatment, expecting firmness and frankness from an Englishman, keenly resenting any injustice. The only artisans worthy of the name—as smiths, masons, carpenters, &c.—are foreigners, principally Portuguese, Germans, or Italians. Englishmen were indispensable as foremen, for plate-laying, and also as engine-drivers and fitters, but too often the English mechanic in Brazil "loses his head." Much of the heavy work, including the completion of the tunnel, was let to North American contractors of experience and means. The greatest number of men employed was 3500 of all nationalities and colours. Mr. Brunlees, in the discussion, said that when the inclines were first laid out he was becoming an old-fashioned engineer, and going backwards instead of advancing, but he had no alternative; he undertook to make the line for a fixed capital of £2,000,000, and the plans had to be adapted to the capital, for ten years ago a locomotive to the top of the Serra do Mar would have absorbed the whole capital. Now he would probably try, on a similar work, to get a gradient of 1 in 14, and employ the Mount Cenis centre-rail system. In such a place as the Serra, where in about four months of every year there was a rainfall of between *fourteen and fifteen feet*, the shortest line was important on the score of maintenance. As an instance of the delay in getting over the ground, in 1860 it took him two days of twelve hours to get from the bottom to the top of the Serra. It was not walking but scrambling the whole way. Mr. Fox had to deal with the same kind of country; in all his experience he had never seen a tract of country which presented so many physical obstacles to the formation of a railway as on this line. It seems a pity that the Canterbury Colony Railway and some of the Indian lines were not laid out by engineers holding Mr. Brunlees's principles. Mr. Bayliss, the engineer of other railways in Brazil, observed that, being within 7° or 8° of the equator, he quitted the primeval forests, not like Mr. Fox, blanched, but more like a red Indian. It was true that Englishmen sometimes "lost their heads" in Brazil, but more frequently their lives. On his works seventy-five of the Europeans were lost by death or invaliding home. He was himself present at the funerals of six of his best men within ten days.

Circular to Gas Companies.

The report of the superintendent of Public Lighting in Dublin for the year ending April 5, 1870, affords strong evidence of the satisfactory working of the plan of supplying gas to public lamps by the average meter indication system. While the number of lights in Dublin has been annually increased, a progressive saving to the Corporation has been effected since the plan was adopted; and the expenditure for the past year has been less by £3873 9s. 3d. than in 1867, the last year under the old system. The saving effected during the three years the system has been in operation amounts to no less than £10,593 16s. 10d. At the same time the superintendent is able to report that the lighting of the city has been satisfactorily carried out, and that the supply of gas has been fully equal to the demand. Dublin, however, is still an insufficiently lighted city. There are but 3330 lamps to nearly 120 miles of public ways, and an area of about 2,610,133 square yards, while in the City of London there are 3000 lamps to 50 miles of streets, and an area of only 770,157 square yards. Under these circumstances, the superintendent has considered how the lighting may be improved, without a larger expenditure from the rates; and he recommends the Corporation to encourage the erection and use of private lights, and to allow the lamplighters, for a small gratuity, to light, clean, and extinguish such private lamps. The circumstances of Dublin are such that we cannot expect any considerable adoption of private lights except in a few large thoroughfares. So far as the gas company are concerned, we are able to say that they are satisfied with the working of the system in the city, and believe they get paid for all the gas consumed. In one of the small out-townships, however, persons have been detected in tampering with the taps of the metered lamps, by order of the local authorities, with the view of reducing the consumption one-half.

We publish in another column the first report of the Glasgow Corporation Gas Committee, and their profit and loss account for the year ending the 30th of June last, from which it appears that upon a gas-rental of £210,736, the gross profit realized has been £61,745 15s. 10d; and that after paying out of this sum a part of the parliamentary expenses, the annuities created by the Act of Transfer, amounting to £30,955 0s. 3d., the interest on borrowed moneys, and setting aside £13,908 8s. for depreciation, there remained £5135 as net profit, of which the Gas Committee proposed to hand over £5000 to the Corporation for general purposes. The proposal, however, was rejected in the Town Council by a majority of two, after an interesting debate, in which it was argued that it would be unjust to the citizens to give any part of the profits to the Corporation until the price of gas was reduced to 3s. or 3s. 6d. On this point, it may be remarked that it seems scarcely equitable to leave the Corporation without profit on the transaction, inasmuch as by pledging the credit of the ratepayers a saving is effected equal to 1 per cent. on the capital of the late gas companies, and to this 1 per cent. the ratepayers are equitably entitled. There was also a disagreement in the council on some other points. The proposed alterations of prices and discounts will place some of the largest consumers in a worse position than they were under the companies. The Clyde Trust, for example, under the new arrangement, will pay more for their gas than they paid before, and it seems clear that none but the smallest consumers will be benefited by the alteration. The answer of the Lord Provost seems to show that the gas companies dealt very fairly with their customers, certainly with the large consumers, since by doing away with the large discounts the Corporation expect to recover £8772. Looking at the whole debate, we may say that it seems to be the general opinion at Glasgow that all profit made in the manufacture of gas by the Corporation ought to be applied to the benefit of the gas consumers.

The transfer of the Leeds Gas Companies to the Corporation was completed on the 1st inst. by the payment of the purchase-money, £696,443, which added to £116,785, the debenture and mortgage debt taken over by the Corporation, gives a total of £813,228 as the cost of the works for the supply of gas to about 250,000 people. This, in round figures, is at the rate of about £3 5s. per head! At the same rate it would cost, say the Board of Works, over ten millions to purchase the London companies.

The Committee of the Sheerness Local Board have reported in favour of accepting the tender of Messrs. Hickmott and Co. for the erection of gas-works. A resolution binding the Board to accept it was carried by a majority of one, in consequence of one member of the Board declining to vote. The tender was for £4100, and the chairman proposed a stipulation that the maximum cost should not exceed £4152. After having obtained an opinion from Mr. Poland that the Board had no power to expend any portion of rates in the erection of a clock tower, and inferentially no power to expend the rates in the erection of gas-works, the Board appealed in their despair to Mr. Tom Taylor, of the Local Government Office. But as Mr. Taylor was away for his holiday no satisfactory answer to the communication was obtained. The chairman, however, maintains that the Board have power to do *everything*—an opinion he may retain until he is effectually undeceived. The public are still excluded from the meetings of the Board, but permission has been given for the admission of a reporter from one particular local paper.

The armies advancing upon Paris are said to contemplate a special raid on the gas-works of that city, and are supposed to be under the belief that they are outside the fortifications. The works at St. Mandé are without the ramparts, though within the circle of the detached forts, so arrangements have been made for throwing these out of action. All the rest are within the entrenched lines, and some are within the line of the old Boulevards. It is to be hoped, however, that the besieging army will not commit the Vandalism of attempting to destroy inoffensive private property, and leave the city a prey to the ruffians who are ready to profit by the confusion. In Strasburg gas has ceased to be supplied, the stock of coals having been exhausted. The same must be said of Metz, where the works belong to a Lyons company.

We may mention here the suggestion of M. Delaurier to employ gas in the defence of Paris. He proposes the use of cannon in which an explosive mixture of ten volumes of gas and 100 volumes of air is to take the place of gunpowder; and, employed in this way, he has calculated that the 14 millions of cubic feet of gas made daily in Paris are capable of throwing more than a million of 60 lb. shot. The cannon he suggests is to be made in the shape of a chemist's glass retort, the belly of which is to be a reservoir for the explosive mixture, and the tube is to form the barrel. As such guns would never foul, and give no smoke, it is urged that they might be used without cessation, and pointed with no difficulty. Another proposal is to store the mixture of gas and air in air-tight cellars and houses, hermetically sealed, to be exploded "at the proper moment." How Paris is to be lighted while the gas is so employed we are not told, and since the guns are not now, and are never likely to be, in existence, we need not speculate on the point, any more than we need trouble ourselves as to how long Paris could supply a daily expenditure of 30,000 tons of shot. Granting, however, the possibility of the use of gas in the way here suggested, the question, Is coal contraband of war? assumes a new importance.

Now that the thoughts of gas engineers are especially directed to purification, we may call attention to Mr. F. C. Hills's apparatus for depriving ammoniacal liquor of its carbonic acid and sulphuretted hydrogen, so that it may be used more effectively for scrubbing. The apparatus was described at one of the meetings of the British Association of Gas Managers by Mr. Upward, and his description will be found at page 581. The first idea of using a desulphuretted liquor for the removal of sulphuretted hydrogen belongs, we believe, to Mr. Laming. It has been carried out, as our readers know, with much success by Mr. George Livesey. Mr. Leigh, of Manchester, too, has patented a process for the partial desulphuration and concentration of ammoniacal liquor for use in purification. In relation to these processes we may remark that the complete purification of gas from sulphuretted hydrogen by previously desulphuretted liquor can never be relied upon, while such liquor appears to have little or no action in the removal of bisulphide of carbon or sulphuretted hydrocarbons, which are beyond all doubt to a great extent taken out by foul liquor. We may throw out also the idea—little likely, we fear, to be completely realized—that the use of liquor purified by Mr. Hills's apparatus and of foul liquor in separate scrubbers might possibly effect a reasonable purification of gas by the simple use of a gas product.

We may here call the attention of our readers to Mr. T. Proud's system of making wooden purifier grids planed on all sides. The particular advantage of perfectly smooth inner sides in diminishing the tendency of the sieves to become choked will be apparent to all.

Mr. R. P. Key has produced a "Meter Life Book or Register," to which we may direct the serious notice of all gas companies. "The plan of the work," as the author states, "although new, is so simple that it will commend itself at once to practical men and working managers." A glance over a specimen sheet will show how, on a single line of a large folio book, may be kept a perfect record of the life, career, and vicissitudes of a meter, from its first introduction to business till it becomes a useless aggregation of old metal. This book will unquestionably prove of great assistance to gas companies in keeping a complete account of their meters.

We have made inquiries, at the suggestion of several correspondents, and find that the Metropolis Gas Accounts for 1869 have not yet been issued. Heretofore they have usually been published in July.

Our subscribers will receive with this number of the Journal a supplementary sheet, containing the ninth of the series of drawings of the Beckton Gas-Works.

Parliamentary Intelligence.

HOUSE OF LORDS.

(*Before Lord* WALSINGHAM, *Chairman; Viscount* POWERSCOURT, *Lord* SALTERSFORD, *Lord* DUNSANY, *and Lord* HEYTESBURY.)

BLACKBURN CORPORATION IMPROVEMENT BILL.

(*Continued from page* 650.)

FRIDAY, JUNE 24.

Mr. *Alfred Smee*, F.R.S., examined by Mr. LITTLER.

I am a member of the Chemical Society, and am surgeon to the Bank of England. For some years I have had an experimental garden on the banks of the river Wandle, below Croydon. About twelve years ago the Croydon Board drained the sewage into the river above my grounds. There were several injunctions in Chancery given against the board to prevent the sewage being drained into the river. Every complaint that was made was absolutely denied by the board. The Chancery proceedings went against them, and they took to irrigation. The effect has been that the district has been converted into a complete water-logged swamp. The emanations from it are extremely disgusting at all times. Last evening it was most unpleasant. Since the irrigation commenced, typhoid fever has sprung up all round the district. As one proof of its bad effect on the land, it is in winter frequented by snipes. I intended to build a house in my garden, but I have not done so, as I consider the place too unhealthy by the contiguity of the sewage farm. Several persons have recently died in the neighbourhood from typhoid fever. A strong cattle epidemic appeared last August in that district, which was attributable, as far as we traced, to the sewage ground, and a letter appeared in the *Times* stating so. Murrain broke out on the sewage ground, and it went round and infected the cattle. Irrigation is calculated to spread disease, as they take from the water-closets of the town all the excreta of the most virulent and contagious diseases—erysipelas, typhoid fever, cholera, scarlet fever, and small-pox—and distribute it directly over the ground, and render it more effective than if it was passed out. It also converts the ground into a marsh, and causes a miasma, which creates marsh fever. The nuisance is dangerous in proportion to its smell. There is a direct poisonous matter which is carried over the land which may or may not be detected by the smell; that is the case with erysipelas and scarlet fever, and the excreta of small-pox patients. Some years ago the Thames went into a state of putrefaction. It caused diarrhœa, nausea, and other complaints. The specific diseases—such as small-pox—when the water is in a putrid state would be less active, although there might be a great deal more smell. All analogy shows that if the sewage has any poisonous matter in it, it is more active in a fresh state, when less offensive to the stomach, than when it becomes more offensive to the nose. If vaccine matter is in a bad state, or putrid, it will not act. If the land is irrigated by sewage to anything like excess, it must unquestionably injure the adjacent wells under any circumstances; the organic matter passes into nitrates and nitrites, and in that state would be discoverable. When vegetable matter is watered by sewage, the sewage is taken up into the juices, and the vegetable is very apt to putrefy. It is very undesirable that sewage irrigation should be managed by local boards, which are generally composed of men in a position of society incompetent to deal with it. The neighbourhood make very great complaints about the Croydon works, but the board will not listen to them. With regard to the spread of entozoa, experiments clearly show that what is cysticerci in one animal becomes tape-worms in another. The tape-worm lodges eggs, which are distributed over the place; it is difficult to trace this on sewage ground, although it has been well investigated. Of course, when the meat of an animal is killed it is distributed miles off, and how are we to trace that to a particular sewage ground? If the meat is thoroughly cooked, many people might eat it without suffering. It is principally dangerous when imperfectly cooked.

Cross-examined by Mr. VENABLES: The water is discharged into the Wandle below my grounds. I am aware Dr. Carpenter is a member of the local board. I do not practise in the Croydon district. My son wrote to the *Times* on the subject of the breaking out of the cattle disease in August. Mr. Marriage was the tenant of the farm at the time. I have seen a letter from Mr. Marriage in answer to my son's statements, which is as follows:—"Sir,—I observe in your last Monday's paper a letter from Mr. A. H. Smee, dated from Wallington, Surrey, in which he states that the foot and mouth complaint has broken out in that district, first amongst the cattle grazed on the sewage farm at Beddington. The fact is, my cattle caught the disease from cattle in the neighbourhood, where it had been prevalent for some time." He also went on to say: "I should have taken no notice of Mr. Smee's letter had not the whole tenor of it tended to impress on the public that there was something very unhealthy for cattle on a sewage farm. Many gentlemen will bear me out that seldom are cattle seen looking so healthy and well fleshed as mine, and I have much less illness amongst my cattle on this farm than amongst cattle I have grazed in Essex. . . . My desire to contradict the attempted effort to raise a prejudice against sewaged land must be my excuse for troubling you with this letter." In that letter he did not state where the outbreak did occur, and we sent a letter to the Croydon Board in consequence. I am aware that the supporters of irrigation consider there should not be less than 1 acre to 100 persons. Here they are much less than that. The ground has become over-choked with water in the last few years. It was not so formerly. I have heard that the board have procured additional ground. I have not observed the working where there was an acre to every 100 persons.

Re-examined by Mr. LITTLER: To my best belief the sewage farm was the centre of the cattle disease. I have heard that, if a pailful of water is taken from the Wandle below Beddington, and kept for 48 hours in the house, it becomes very offensive. When there was a much smaller population, nasty smells arose from the farm; but I think it is getting cumulatively worse every day. I believe the soil is losing its power of destroying the sewage. If soil is continually saturated with sewage from year to year, it will get worse. The surface of sand exposed to the air has a high oxidizing power, which it is very apt to lose after a time. Clay will not take up above a certain quantity.

Mr. *Wm. E. Cressy*, M.R.C.S., examined by Mr. LITTLER.

I am surgeon to the Female Orphan Asylum at Beddington, and to the Beddington district of the Croydon Union. My practice lies around the Beddington farm. We have had the typhoid fever in every house in the estate since 1867, when the first cases occurred. At Beddington Corner, almost every case assumes an enteric form of irritation, which is what we expect to find when the air and water are polluted with sewage. In consequence of the complaints, I have had to report to my board of guardians. I did so on June 13, 1870, as follows:—"I visited all the houses situated at Beddington Corner on Saturday last. The inhabitants, with two or three exceptions, are people above the condition of paupers, consequently you have no returns of death from me as medical officer of the district. I found the houses, for the most part, overcrowded, but not so as to account for disease. The greatest defect arises from bad water-closet arrangements (generally a common privy over a cesspool, having an overflow in a drain), and the condition of nearly all was that of neglect of being emptied; this is only relieved by the distance of the dwellings—viz., about 20 yards. The water is drawn, or rather pumped, from local wells, and is in many houses complained of as bad, and in all was of doubtful aspect and smell. The wells are not close or near to the cesspools; they are in some instances close to drains on the surface. Scarlet fever has prevailed in some half dozen houses (the whole number being about 30). The number of deaths has been four cases, and these all happened near together, in one house—Mr. Packham's. I examined the premises by permission of the lady of the house, who is not a patient of mine. I found she had had fever, and had lost four girls, attended by Mr. Marshall, of Mitcham, as private patients, and found the premises in excellent sanitary condition, except that they had cesspool arrangements; but all was clean and well cared for. I could find no local cause for fever except that the house is the nearest—viz., 30 paces from the outlet of the culvert occasionally discharging sewage water into the brook there from the Croydon sewage works. This culvert is supposed not to be used, but I find that it is used periodically, which can be seen by the yellow colour at the bottom of the brook. This culvert runs past the whole of these houses, at a distance of about 15 yards. These houses have for some years been the seat of disease, showing imperfect conditions, and have been many times reported to Mr. Williams, your officer of health, or inspector of nuisances. Nevertheless, there has been no mortality, in the way of epidemic diseases, to furnish material for an appeal to a higher authority. We have had much gastric and irritation, but few deaths anywhere. I am of opinion that this particular locality suffers from the propinquity of the Croydon sewage grounds. I believe the wells are affected thereby to some extent. There have been a few cases of typhus fever in the last two years in the neighbourhood of my practice. I cannot record any deaths from that disease." There are few houses near the sewage grounds, and they are built in Beddington Lane by the owner of the sewage grounds. There has been fever there. I have seen new houses standing where they were built, unlet, and Mr. Macrae bought one there very much under the price I am paying at the present time for a similar house.

Cross-examined by Mr. VENABLES: In consequence of my report the Croydon Local Board directed their engineer, Mr. Latham, to report upon this.

Mr. VENABLES: Mr. Latham says: "I wish to draw the board's attention to a great infringement of the rights of private property, and to a nuisance to your freehold estate at Beddington, caused by the neglected condition of the cesspools of the houses adjoining the private property of the board, which are overflowing on the board's estate."

Witness: That is the same spot I was speaking of. Mr. Packham was the gentleman in whose house there were four deaths.

Mr. VENABLES: He says: "That the whole of the houses to the south-west and north-west of Mr. Packham's house have cesspools and privies, which are full of fœtid matter, giving off a most disagreeable odour."

Witness: They had cesspools and privies in a very imperfect state. I do not know whether the first death from fever took place on the 28th of April. I never spoke of the irrigation works affecting children. I spoke directly of the mouth of the culvert where the effluent water goes out. "Mr. Cressy is correct when he says: 'As to this being the nearest house to the outfall, is totally incorrect.'" The culvert he refers to is evidently the one formerly used for conveying the effluent water from the irrigation works, which is much nearer the Old Queen's Head than it is to the house of Mr. Packham.

Mr. VENABLES: The more important part is coming: "The statement made by Mr. Cressy that this culvert discharges sewage water from the sewage waterworks is also incorrect. No sewage water whatever has been passed through the culvert in question. Nothing but perfectly pure water has ever passed from that outlet into the river."

Witness: Then I must refuse to believe my senses. The brook is as yellow as possible, and the people there tell me that whether their culverts lead, or what not, there is a great deal comes down, especially at nightfall.

Mr. VENABLES: The sewer you speak of has only been used for a few days within the last fortnight, while the other outfall works were under repair. It was not in use on the 28th of April, or previously, so that the effluent water at this point could not have had any influence on the cases in Mr. Packham's house.

Witness: Can anything be more dangerous than a culvert in which sewage is only occasionally used?

Mr. VENABLES: Mr. Latham also says: "The landlord of the Old Queen's Head made a request that we should occasionally let our effluent water pass in that direction, in order to purify the stream which is now fouled by the discharge from local sewers."

Witness: There is no local sewer to get in.

Mr. VENABLES: "The results recorded by the Rivers Commissioners, who have made analyses of the effluent water passing off our irrigation works every week during the year, at periods unknown to us at the time, and which are recorded in their recent report, show conclusively that no sewage has ever passed during the last twelve months into the river Wandle, and that the water passed into the Wandle is as equally pure as the water of the river itself."

Witness: There must be some discrepancy between the theoretical and the practical modes of managing the Croydon sewage. I do not agree with Dr. Carpenter's theory regarding the Female Orphan Asylum, and some of the statements with regard to that institution are incorrect. The fever there did not occur from the cause he attributed it to.

Re-examined by Mr. LITTLER: The fever of which the four children died was principally caused from the smell of the effluent water as it is called, but which is occasionally loaded with sewage. The water that comes thence is absolutely copper-coloured at times.

Mr. *George Neville Turner*, examined by Mr. LITTLER.

I reside at Park Lodge, Croydon. The sewage farming is decidedly a nuisance, I have experienced it for the last five years, even when the population was much smaller. It was a slight nuisance then at times, not so constantly as now. That may be accounted for from the fact that the population of Croydon has doubled itself in ten years. It was 30,000 ten years ago, and now it is 62,000.

Mr. *Wm. Jackson Rideout*, examined by Mr. MICHAEL.

I am a paper manufacturer carrying on business at Farnworth Mills, on the river Croal, about 12 miles from Blackburn. The population of Bolton is 80,000. I have paid considerable attention to the subject of clarification of water. The waters of the Croal are saturated with sewage and other manufacturing pollutions. If I collected some in an ordinary glass bottle, you would barely see through it. We have bleaching works, and chemical works, and almost every manufacture carried on above us. Sometimes the sewage floats on the surface of the water, and is so offensive that you can hardly stand upon the river banks. As we require large quantities of water, we have to purify it. We pump the Croal water into eight subsiding reservoirs. We require to have the water perfectly colourless for paper-making. I have seen the condition of things at Blackburn. The water of the Blackwater at Blackburn is very similar to that which I take. When I get the water into the subsiding reservoirs, I let it flow slowly from one to the other, so that as much of the heavy substance may settle as possible. We expose it to the action of the sun and air to oxidize it. The reservoirs are as shallow as we can make them; their area is rather less than 12 acres—56,670 yards. We filter it through sand filters. The reservoirs will hold about 10 million gallons of water. We filter upwards of 800,000 gallons daily, but we have appliances for a million gallons. The area of our filtering-beds is 7480 square yards, or 1¾ acre. After the water has been so filtered it is so clear and pellucid that it is difficult to distinguish it from spring water as regards colour. The filter-beds do not get choked up so rapidly as is imagined. With care and attention they will run from three to four days without requiring scraping. Our process is then to allow the water to drain off, and a film of dirt forms upon the surface of the sand, and this we either brush or scrape off, according to its thickness. It is in such a condition that it would be easily saleable for manufacturing purposes. I was one of the millowners appointed to confer with the Royal Commission, and was one of the committee of millowners appointed to watch the Mersey Bill in 1862. The only

scheme I can see for the purification of water is to have a tank, and precipitate all the sewage water by the A. B. C. or some other process. I am perfectly satisfied such a process can be satisfactorily carried out. I threatened Bolton with an injunction, and they are now adopting the A. B. C. process, by consent, to see whether this process cannot be carried out. I do not see how large towns are to carry out irrigation. It is only a cumbrous form of filtration. At Manchester it was proved they would want 50 square miles of land for irrigation. I should not like to live on a sewage farm. The cost of construction per yard of surface for a filter-bed is 30s. Our filter-beds have lasted 12 years, with the occasional renewal of sand. We only filter through 3 feet, and find it sufficient.

By the COMMITTEE: I mean 3 feet of sand and 3 feet of gravel.

By Mr. LITTLER: There is no practical difficulty in carrying out this on a large scale. The Rivington Water Company's beds occupy 30 acres. I made a report to the Rivers Pollution Commission. This scheme would not cost Blackburn half so much as irrigation, according to my estimate. They would be able to sell the water, which would be valuable, and they would find ready customers among the population. I should be sorry to have an irrigation farm of my own. In our own case we irrigate some 7 or 8 acres of land as the first process. We avail ourselves of the high land, and irrigate where we can, but the grass is so bad that we do not give it to the horses, and we do not keep cows. It is used for waste and packing purposes. It is the same sort of land as that at Blackburn—clay mixed with sand. In winter the water runs off just in the same state as it runs on The land is so saturated with water four months out of twelve as to cover one's shoe-tops. I have no doubt the A. B. C. system, now being tried at Bolton, will be successful. I believe it to be the most feasible process that has ever been submitted for a manufacturing district when water is wanted. There is scarcely a township in Lancashire that is not greatly concerned to obtain a supply of water. In a manufacturing district like Blackburn I think every ounce abstracted from the river is a serious injury to the trade.

By the COMMITTEE: The Croal is much larger than the Darwen—ten to one.

By Mr. LITTLER: The quantity of sewage that comes from them is nearly equal. My scheme could be constructed and be in full operation in two years.

Cross-examined by Mr. VENABLES: If there were a million inhabitants in Manchester it would take only 10,000 acres for irrigation at 1 acre per 100 persons. I question the rule of 1 acre per 100. There is a junction of the Croal with the Tonge, the Bradshaw Brook, and several others. Bradshaw Brook is a considerable stream, and runs in below Bolton. The Tonge runs through Bolton. I do not know its average flow. It has a large drainage area. It is a very high country, with a large rainfall, and with many impounding reservoirs. It is only a month ago since it was agreed to put the A. B. C. process in motion. We are dealing with the water now the same as we deal with the water at Farnworth Mills. We have not the benefit now of this process. The sewage of Bolton flows direct into the river. The water-works of Bolton are very complete. They can afford 30 gallons of water per head of the population. The water of the river is so saturated with sewage and filth of every description that it is held in mechanical suspension, and if put into a tumbler it will subside in five minutes, therefore it cannot hold any more; it holds as much as its velocity will carry down. The water at the sewer outfall at Bolton would be very little fouler than where it passes my works. There is not much difference in the water before it comes to Bolton and when it leaves Bolton. I would prefer to live in the neighbourhood of the Thames as it was ten years ago than that of the Croal.

Mr. VENABLES: The sewage matter of Bolton is mixed with 2½ million gallons, being the full supply of Bolton, and that is all the dilution it has. When it comes into the river it gets some additional dilution, does that make any difference?

Witness: I do not think it does, because there is a deposit of mud in the river 10 or 12 feet thick in places. When the heavy floods come they sweep the whole of that into the lower part of the river.

By the COMMITTEE: The expense of filtering-beds at £30 a square yard would be £7260 an acre. Forty acres at that rate would involve £288,400. They do not require 20, or even 15 acres at Blackburn.

Re-examined by Mr. MILWARD: Our corporation has 12 acres of subsiding reservoirs, and about 1¾ acre of filter-beds, by means of which we actually filter a million gallons per day. On the same principle 3½ acres would filter the 2 million gallons of Blackburn, at a cost of from £28,000 to £30,000. The 20 or 30 acres required for subsiding reservoirs would be a matter of very small cost. If the ground is sloping, we make first one subsiding reservoir, then another, and another, so as to let the water subside the one into the other. In the Manchester calculation we figured out the population of the drainage area (a great many streams running into the Esk before it reaches Manchester), and we allowed for a ten years increase of population.

By the COMMITTEE: I think the whole of our 12 acres for subsiding reservoirs did not cost more than £3000 or £4000. We merely throw up small embankments; there is no large conduit.

By Mr. VENABLES: I do not include the value of the land in that.

By the COMMITTEE: I was paying £5 an acre rent for the adjoining land. I am now proposing to make two reservoirs of 3 acres, at a £15 rental. The average depth of our reservoirs is 2 feet 6 inches. We irrigate as far as we can, but find it of no use to us. The corporation of Bolton are going to experiment with the A. B. C. system, at a cost of £2000. I have a cotton-mill two miles lower down than Farnworth, and the sewage water is so offensive from the Croal, the Erle, and another river which joins it, that the mill is now stopped. In weather like this we frequently have to stop our water-wheels, because the disturbance of the water causes such an offensive smell that the workpeople cannot remain. After using the water in the paper-mill we send it down the river. The water which gets to my cotton-mill is fouled by the water-mill and from the sewage here.

Mr. *Joseph Jackson*, examined by Mr. LITTLER.

I have been in practice in Lancashire as a surveyor for the last thirty years, and have had considerable experience in the management of lands. I am the district engineer of the Liverpool Corporation Water-Works at Rivington. The estate of Mr. Petre, whether looking towards the Darwen or the Ribble, is a beautiful one. At present it is used principally as a farm land, but it is in such close proximity to Preston that it must in a very short time become building ground; it is the most beautiful district about Preston, with two good roads leading into it. I would not build cottages there, but villa residences, with a few acres attached. It is well wooded. I do not know of any instance up to the present time where anything like this acreage of land has been taken in such a situation for sewage works. The land is totally unsuitable for irrigation purposes, taking into account the large rainfall, which is so heavy in the winter that neither horses nor cattle can be put on the land. It would be a great expense to drain it so as to run the water off rapidly. It is very different from ordinary farm draining.

The CHAIRMAN: But you could not build upon it till you had drained it. One part of your case is that it is not fit to put a beast upon, and the other is that it is building land. It must be drained before it becomes building land, or at all adapted to any other purpose.

Mr. LITTLER: Yes; but building land would make a great return for your outlay.

Examination resumed: I have the control of the Liverpool Corporation's filter-beds at Rivington. They were until lately 6 acres, and I have just added 2 acres more. This is for the water-works. We filter from 10 to 12 million gallons per day. The practice carried out at Bolton is perfectly successful, so far as cleaning the water goes. I see no difficulty whatever in applying such a system to Blackburn. I think the plan proposed by the promoters most extravagant. The Bolton scheme could be carried out with a fourth of the expense. The saving of water, too, is another recommendation. Water on the stream is more valuable than crops on the land in this district, even supposing it to be a commercial success. Applying Mr. Rideout's scheme to Blackburn, it might cost £40,000. I am satisfied it would have the desired effect. The water would be restored to the river for manufacturing purposes again; the millowners are entitled to it, I believe, now. I do not think there is any value in the product got from common filtration.

Cross-examined by Mr. VENABLES: I do not agree with Dr. Frankland that from 2000 to 3000 acres are required for the filtering process. It is a question whether, when the land is purchased, it will represent the £47,000 paid for it.

By the COMMITTEE: At times there is a great deal of water in the river from the great rainfall, but at times there is not.

By Mr. VENABLES: The drainage area at the Liverpool Water-Works is 10,000 acres. The daily flood of water per 1000 acres has been down to less than half a foot a second—very nearly down to a quarter of a foot a second in the Liverpool district generally—and throughout Lancashire it is half a foot a second; that is about 3 gallons. For 12,000 acres it would be 30 gallons, or 2½ millions a day. There are 800 acres of drainage-ground that supply the liquid matter of the sewage of Bolton, and 12,000 acres supply the river at Mr. Rideout's works.

Mr. VENABLES: And I suppose the proportion of river water and the water mixed with sewage in Bolton would be just the same—1800 to 2000.

Witness: I dare say it would; but you must recollect that the 2000 acres are also saturated with sewage to a large extent. The country is full of large villages; mills of every description—paper-making, bleaching, &c., works—all of wich turn their foul matters into the river.

Re-examined by Mr. LITTLER: In addition to the water that goes down the sewers a certain quantity comes from the mills, which never comes from the water-works at all. Some of the mills collect the water, filter, and send it through the sewers, and it then comes back as waste.

By Mr. VENABLES: The level of Bolton is, perhaps, 40 or 50 feet above the river, but the buildings extend right down to the banks of the river.

Mr. VENABLES: Supposing the people of Bolton wanted to get ground for irrigation anywhere near the town, they would have to take it at a higher level than the river?

Witness: They might turn it down the valley daily, and could turn it into the lower ground. There is land capable of being irrigated five or six miles down. If they wanted to send it on the land anywhere within a mile of Bolton they would have to pump it.

By Mr. LITTLER: If the promoters were to take their sewer about eight miles they might get land on the coast to any extent, where irrigation would not hurt, without preparation or expense. Round the coast there are sand banks of thousands of acres. I know the country, and there is quite sufficient fall for the sewage to run down rapidly, so as not to come to any harm, if taken in iron pipes. They would not need iron pipes all the way, a great part might be brick. In dry summers you can jump across the Croal in places between Bolton and Mr. Rideout's mill. As to the increase of drainage, the water goes off quickly in rapid floods, and the day after there is very little water; but in these rivers most of the water is bottled up by different people's reservoirs; at night time in the summer there is scarcely a drop of water going down.

By the COMMITTEE: I understand they were proposing a culvert of 2 feet 6 inches to take the Blackburn sewage. Iron is most expensive. I consider 5 to 6 feet in a mile sufficient fall.

By Mr. LITTLER: The pipe to Liverpool, which carries 5 million gallons 24 miles, is 44 inches diameter. The fall from Blackburn to the sea, from the place it is proposed to let out the sewage, is 250 feet, I am told.

Mr. VENABLES: I am told it is 5 feet per mile.

Mr. LITTLER: This place is 320 feet above the level of the sea, therefore the fall would be more.

Witness: I speak of the estuary of the Ribble upon the tideway.

By the CHAIRMAN: The distance is 12 miles, which would be 30 feet to the mile. There is no difficulty about the fall.

Mr. *James Lomax*, examined by Mr. LITTLER.

I am a surveyor of Bolton. I was formerly a member of the Bolton Town Council. I have examined the site of the proposed works, and have paid attention to the subject of the treatment of sewage. I have visited Carlisle and Edinburgh. At the latter place I do not see that any new buildings have been built within the site of the Craigintinnie lands for a great number of years. I do not remember having seen any dwellings near. At Carlisle the condition of things is different, inasmuch as they do not deal with the quantity of sewage there that they deal with at Edinburgh or Blackburn. They only deal with a small portion of the sewage of the town. They take what they want, and the rest runs to waste. The population is 31,000, and I believe they deal with a third of that portion which runs through an intercepting sewer. In addition to that, the land is the old bed of the river Edney, and an absolute natural filter. The water runs through, and they have no occasion for outlet drains. I could not see any effluent water. I asked persons on the estate where the water went after passing through the valley of Holms, and no one could tell. Having regard to the unprofitableness of irrigation schemes, and the large extent of land required near Blackburn, the promoters scheme is not the preferable one to adopt. There are in other Lancashire towns a large number of houses and villas supplied by cesspools. If the cesspools are covered in there is no difficulty of carting off their drainage into the sewers. There is no prospect of water-closets being applied to that class of property. If they were adopted it would be a great abomination. That portion of the sewage would always have to be dealt with on the dry system. It renders it desirable that those should be cut off from all communications with the sewers.

Cross-examined by Mr. MICHAEL: I am an advocate of the privy system, but not as you have it at Blackburn. I say ashpits should be put under proper management by the local authorities. They should first cut off the connexion between the ashpits and the drains, and then cover over the ashpits and utilize the ashes; that is the fine ash, and not the refuse. A cesspool may mean one thing in London and another thing in Lancashire. With us it is a place which receives the overflow of sewage and excrement from the water-closets; an ashpit is a pit alongside a privy, in which ashes, along with the excrement, are put. I should put the stuff which is emptied from the cesspools and ashpits on to the land. They would require to be done as often as it is done at present. When the ashes were sifted by the proper method they should be put into deep holes, and mixed with the water of the liquid sewage excrement from the cesspools; but for my own part I would abandon cesspools. They are the greatest nuisance that was ever allowed, therefore I would not allow them, but would reduce myself to privies and ashpits. There is no privy and ashpit in my house, but for every house I would do it. The landlord should make the privy first, and the town authorities should keep it continually in working order. They empty it twice a year as a practice. Each cesspool should be 4 feet by 3, and 3 feet 6 inches deep. The refuse should be collected when dry, and removed every morning. The slops would go into the sewer and be precipitated. That would be a compound process—a solid manure created, and a water system of sewers. I would precipitate the liquid sewage in tanks, and afterwards filter the effluent water. The size of the filter would depend upon the quantity of the sewage. I should have to deal with about 70,000 gallons with a population of 80,000. I would separate the watershed of the town from it if possible, by the introduction of a little contrivance by which the shed water is drawn into the river,

and a larger quantity of sewage water is received into the intercepting sewer to be dealt with. I am assuming that the stream water is now taken into the sewers at Blackburn. I made some experiments on my own premises. My filter had timbers outside, and I had no internal precipitation. I simply put 20 gallons into separate cisterns, and tried how long they would take to precipitate it, and I am satisfied that 24 hours would precipitate it entirely without any chemical substance being put into the water. I do not say it will be pure, but it will make it in such a state that the remainder can be filtered to perfection. I did not test it chemically. The water tried that way was fit to be taken into the river. The effluent water was tested by putting it into a glass, and seeing it was clear. I do not say it was fit to drink, nor is there any water coming from Edinburgh which is fit to drink. I would mix the fine ashes with the solid excrement to make manure. I would send the liquid portions down by a precipitating sewer to tanks made for the purpose. It does not require a large amount of surface. My plan is to bring all the liquid matter down to some point where I am to deposit any solid matter into it, and then trust to filtration.

Re-examined by Mr. LITTLER: Sewers exist in Blackburn. The cesspools are in existence, and the corporation are trying to mend their ways. The rainfall will go into the storm-sewer. With proper arrangements, combined with the penalty clause, it will save Blackburn £3000 a year. Bolton is a fair criterion for Blackburn. The 2 million gallons dealt with at present would be very much reduced if they had a proper system of covering in their cesspools. They have no business to have more than 70,000 gallons a day. The stuff taken from the ashpits would be a valuable compost, and a considerable amount of stuff of this kind is sent annually from Lancashire to Lincolnshire.

Mr. *Wm. Harper*, examined by Mr. LITTLER.

I am clerk to the Local Board of Health of Bury, in Lancashire. For many years previously I was a member of that board, and took an active part in sanitary matters. In 1843 there was a commission appointed under the Health of Towns Act, and an inquiry was made. I assisted. In 1862 and 1863 a very lengthened inquiry was made into the watersheds of the Irwell and the Mersey. Bury may be said to have been entirely sewered within the last 15 or 20 years. The population is from 30,000 to 40,000, and there are about 100 water-closets, principally in houses inhabited by the richer classes. Our cesspools are not in so good a condition as they ought to be. We insist on their being made in all new houses, but the storm water and the rain water on the floods get in, and wash off the manure, and it is less valuable when it is carted away into the country, in consequence of the construction in the older system of houses. With all newly erected property we exact more stringent regulations, but find a great difficulty in dealing with old houses, which have a sort of prescriptive right to be a nuisance. It is quite right that the promoters should take power to deal with old as well as with new houses. If they have a proper system of ashpits, and if the storm water is kept out of them, the difficulty will be lessened. There is no prospect of any thorough working process being adopted in these towns at present. We have not the water for a water-closet supply. I think that with care there is a possibility of dealing with the sewage satisfactorily, as far as that portion of it is concerned. In Liverpool they are not going on with the conversion of water-closets as they once did. I have been told that the application of that system at Liverpool has not been followed by any marked improvement in the health. I think that much better means than the irrigation scheme ought to be applied before it is assumed that irrigation is to be the cure for everything. The deprivation of water from the water-works or what comes into the sewers would be a very serious matter. The sewage farm would be so costly as to be a burthen on the community. Irrigation has been studied at Bolton, and it would be the last thing to which we would resort. We do not consider that the problem has been solved. The great desideratum is to get the manure in a dry state. If it pays the cost of its making and carriage, it is a great gain. The Oldham manure is carried away to Stockport, where it obtains a remunerative price. I am satisfied that the combination of precipitation with filtration can be carried on with considerable advantage. Sir Joseph Heron's evidence was that if the river at Manchester were parallel to a sewer, and if the whole of this district were to be clarified, it would require 50 square miles. That contemplated not Manchester alone, but Salford and Rochdale, and the manufacturing pollution as well as the pollution from the inhabitants. I do not think Sir Joseph's statement was at all exaggerated. When there are populations crowded together in towns within a few miles of each other, it is practically impossible to have irrigation farms dotted about without creating an artificial fen or marsh, and it would be such a nuisance that the country would not tolerate it. Manufacturers and merchants are not likely to take villas in the neighbourhood of an irrigation farm, but still I think they like to live out of the atmosphere of their own smoke.

Cross-examined by Mr. MICHAEL: Sir Joseph Heron, in his calculation, contemplated purifying the whole of the water into which the refuse of manufactories flows. That is not sewage, but it is quite as bad. I say that I consider house slops to be an important matter. I should think it is by no means so bad as water-closet sewage. I have never heard that, in a sanitary point of view, the ordinary slops are worse than the whole of the sewage water. I cannot instance a town where cesspools have been so constructed as not to be a nuisance, but at the Wakefield House of Correction, where Mr. Mole's system is in operation, they are free of nuisance. I do not think Mr. Mole's system can be applied to a large town.

Mr. MICHAEL: Then would you recommend that Blackburn should continue to retain the whole of its impurity in the neighbourhood of inhabited houses? Would you recommend a continuance of the ashpit and cesspool system?

Witness: Yes; if they passed a lot of regulations, and appointed a staff which would work it out efficiently.

By Mr. MICHAEL: Such regulations are very difficult to carry out.

Mr. MICHAEL: Do you agree with the report of the Rivers Pollution Commissioners: "Even where the scavenging is organized and well directed, as it appears to be both in Liverpool and Manchester, much of the nuisance of the privy system seems unavoidable, taking the latter town for an example of even better management than can be ordinarily expected. It is impossible for any one examining the poorer, and even the second-class districts of the town, to avoid the conclusion that most injurious accumulations of filth are suffered to exist"?

Witness: I do not agree with it. The commissioners are not infallible; they speak from evidence and information.

Mr. MICHAEL: Do you agree with this passage in their report: "However perfect, then, in theory the ashpit privy may be as a means of house scavenging in towns, in practice it has been abominable"?

Witness: I think that is going too far, and saying more than the commissioners are entitled to say with regard to Manchester.

Re-examined by Mr. LITTLER: I do not believe the Blackburn Corporation intend converting all the privies into water-closets, because it cannot be done in the manufacturing districts. The A. B. C. system, from what I saw at Leamington, certainly produces such an effect upon the sewage water there that it deserves a further investigation and inquiry before a large outlay is incurred in irrigation.

Mr. *Frederick Eggar*, examined by Mr. RODWELL.

I am an engineer, practising both in London and Aldershot. I am a land agent, and chairman of the Aldershot Local Board. A notice was served on the board of an application for an injunction to restrain the town from draining into the Blackwater River. The civilian population of Aldershot is about 7000, out of which about 3000 would drain into the stream; the others have no closets, but they have one thing or another, and to them the system of drainage has not been extended. An allegation was made that if the town was restrained from draining into the Blackwater, the Government should also be called upon to be restrained, they being larger contributors than the town itself. That allegation was rejected by the authorities there, as they had been led to believe that the farm was perfect in its operation in using the sewage as it came from the camp, and that the water therefrom went straight into the Blackwater in a perfectly pure and clarified condition. We appointed a committee to inquire into all the circumstances connected with the injunction. We followed the river to the boundary, and in turning backwards we inspected the farm, which we found was running this sewage directly into the Blackwater, scarcely any portion of it going to the farm. That was on the 26th of September last. We went over different parts of the farm, and found that the sewage was being strained through a system of gratings. The liquid passed straight down to the river. The committee reported that the board should cleanse the stream as far as was in their power, and having expended their money in the cleansing of the stream, the Government should be asked to give us a contribution towards that expense. Government spent a large sum of money on the farm. When the farm was first talked of I saw the estimates, and the contemplated outlay was £7000. When the land is under irrigation the smell is so offensive that when you are passing along by the railway it is quite manifest a quarter of a mile distant. Wishing to confirm all that I had seen on the farm, I invited Dr. Letheby, Mr. Hawksley, and Professor Huxley to accompany me to the inspection on the 1st of May. It was Sunday, but it was impossible for them to go down on any other day, and I presume we were not expected. We found the farm in precisely the same condition as it was on the 20th of September—the sewage was passing direct into the Blackwater from the inlet into the farm. About an acre or so was at the time under irrigation. The produce of the farm is constantly very good indeed, inasmuch as Mr. Blackburn and his bailiff have exercised the wise discretion of only putting on the water at particular times when they want it, and letting it run into the river when they do not want it. Consequently the land is never over irrigated. Mr. Rawlinson held an inquiry at Aldershot in December. He did not confine himself to the evidence which was then given, but took upon himself to state a theory which does not at all bear upon the evidence which he went down to take. The local board is in communication with the Home Secretary, and it is determined to have an official inquiry by the Government as to the statement made in that report. I visited Banbury on the 20th of April last. On the admission of the sewage it flowed from 16 acres into about 12, and from 12 into about 10. The sewers were all filled, and the sewage was running into the river Cherwell without being purified in any way. I could smell it most powerfully, and it appeared to be in a most unwholesome condition. On the first 16 acres, where the sewage had been strongest, there was not one-third of a plant of a crop of rye-grass. I next visited Birmingham, where there is about 130 acres. There they run their sewage into filtering-beds, from which they lift the sewage in troughs, and it is then taken into fields, where it ferments for months, and a more vile state of things cannot be imagined. The irrigated portion is about one-sixth of the whole, and I confess it was much worse than I expected to see. I also visited Croydon, and I consider the whole system there to be a failure from beginning to end. I saw it on Monday last, and I never saw anything in a worse condition than it is now. I have inspected the Croydon farm ten times at different intervals within the last four or five years, with the express view of seeing what irrigation would do to land. During the past year, when Mr. Marriage occupied it, it was chiefly devoted to grass, which became so exuberant from the excessive manuring that he could not dispose of it. In consequence, he devoted his attention to cows and milk; but that was an equal failure, and at the end of seven years he was not disposed to take the farm, except upon very moderate terms, which the local board refused. There are 310 acres upon the farm there, and about 100 acres in what are intended to be in roots, but the mangold-wurtzel is smothered with weeds.

By the COMMITTEE: The soil is suitable to absorb and drink any liquid running upon it.

By Mr. RODWELL: I have been to Norwood, where there is the best managed and set out sewage farm in the kingdom. The public footpath runs across it, and the smell is very offensive indeed. Out of 26 additional acres they have taken, there are about 8 acres as to which they have given an undertaking not to irrigate, because there are houses near to them, the proprietors of which would obtain an injunction if they attempted it. I visited Rugby on April 22, which is the best situated farm of any in the kingdom for irrigation. The crops there on the hills are good, but in the valleys they have been destroyed by excessive manurings. There was the same smell there. The farm is isolated, and is about a mile from the town. I deemed it my duty to inspect all these places to ascertain how far it would be applicable to our parish. I do not think the time has arrived for anybody to say what shall be the utilization of sewage. I have read the Rivers Pollution Commissioners report. It is a theory from beginning to end. Their determinations are not such as should influence any committee as deciding upon a system which any town should adopt for the utilization of sewage. The only place where anything like a profit has been derived is Banbury. Two years ago a considerable profit was made; it has since diminished, and this year it will be *nil*. I have examined this matter a good deal, and I have not seen one single scheme which, as a rule, would do for general adoption. If time were allowed by Parliament for examining into various schemes in order to see whether they went to a certain extent one way or the other, I believe that there would be something like a perfect system laid down which would then meet all the requirements of the country.

Cross-examined by Mr. VENABLES: I do not know that Mr. Blackburn's potatoes on the Aldershot farm ever turned out bad except on one occasion. If the flowing of the liquid into the Blackwater did not constantly take place, I would not attempt to mislead the committee by any such assertion. Mr. Diggs, of Ash, was the person who threatened me with an injunction. His property is considerably above the camp farm, and higher up the Blackwater. He complained that the Blackwater was polluted there. It could not possibly have been polluted by the camp. I applied to the Government authorities to take a part of the expense above the outfall, because it fell to us to cleanse the river as far as the river boundary, which takes in our own boundary. In consequence of this report Colonel Chesney reported to the military authorities, and his report was presented to Parliament dated the 11th of December last. The following is addressed to the clerk of the Local Board of Health by Colonel Chesney.

Mr. VENABLES here proceeded to read the letter in which Colonel Chesney stated, in reference to the alleged pollution of the Blackwater by the camp sewage farm, he had caused a thorough inquiry to be made into the whole matter by two competent officers, and had personally tested the results. The letter went on as follows:—"The simple fact is that the Blackwater, before reaching the vicinity of the camp farm, is found to be foul and thick with the sewage of the town of Aldershot, and, upon taking a specimen of the water from above the point where the drainage of the farm first reaches it, and leaving the same to stand for a time, there becomes separated a black mass of dirty sediment, the origin of which is quite unmistakeable. A similar experiment tried with the water of the river just below the farm shows it still to be indeed dirty, but very much less dirty than above, and certainly with considerably less deposit. This is not surprising, for of the outlets, five in number, through which the camp farm discharges, one was dry, and the water of the three others flowed clear and good from the farm, cleansed from all impurity by its passage through the land, and it is actually in considerable use as drinking water. I must remark, however, that it does not reach the Blackwater in this excellent state. It has to pass through certain ditches in the intermediate space, which ditches are never apparently cleared, and form receptacles for all the filth accumulating from the four public-houses adjacent. Moreover these ditches are frequently

overflowed from the river itself in the flood seasons, and the water then left behind in them of itself constitutes a source of offence, for, as I am credibly informed, on such occasions solid undissolved sewage matter is frequently deposited. Let me further remark that the statement I have made as to the quality of the water drained off the camp farm is not merely an opinion. It rests upon an analysis made by Mr. Abel, the experienced chemist of the War Office. . . I regret that I do not feel justified in making any application to the War Office respecting the cleansing of the river."

Witness: Professor Abel says: "The filtered liquid contained 20·4 grains per gallon of nitrogen, existing as ammonia and the sewage matter." I think he made a mistake in a decimal point, and meant 2·04.

Mr. VENABLES: Although this is stated to be 20 grains, I find that in another analysis they are stated to be 29° of combined nitrogen at Aldershot, and the sewage is stated at 13 and a decimal.

Witness: That is nearer the truth, but it is still in excess. The Government did not spend a shilling on this farm. They spent £1000 on the latrines, and the other £7000 was applied to carrying out the drainage. With regard to the quantity of sewage put on the Beddington farm, I simply go upon the statements given to me as to the quantity supplied.

Re-examined by Mr. RODWELL: In the report of the Pollution of Rivers Commissioners at Manchester, the total solid matters in solution are 58·3, and the total combined nitrogen is 5·156. At Salford the total solid matter in solution is 160·7, and the combined nitrogen is 30·638. I cannot agree with these analyses, as they are framed too much upon theory. We have appealed against Mr. Rawlinson's report.

Mr. *Edmund Caswell*, examined by Mr. LITTLER.

I reside at Leamington. As a ratepayer, I have taken a great interest in the disposal of sewage. The A. B. C. process has now been in operation about eighteen months. There has never been the slightest complaint of any nuisance until within the last two or three weeks, which has arisen from the company not having provided the proper quantity of machinery for using the whole of the sewage, as their tenure was uncertain. About two or three weeks ago they got increased centrifugal power for working this up; they commenced working it in a very hot season, and they put up mills which have produced a little smell. In an ordinary working of the process there is no nuisance, and it is now removed. The manure from these works is very valuable. I have tested it side by side with Peruvian guano and artificial manure, and the result is very satisfactory. I prefer using it to any other, and am willing to pay £3 10s. a ton for it.

By the COMMITTEE: I sell my own stable dung, and get 6s. 6d. a ton for it.

By Mr. LITTLER: The demand is so great that they are unable to execute all orders. I have not heard a single complaint about it. One gentleman sends 40 or 50 miles for it, and pays cash. I have no pecuniary interest in the concern. I produce a sample of the effluent water coming off the works. People cannot tell the difference between the river water and the effluent water. Fish thrive about the outfall.

Cross-examined by Mr. MICHAEL: I have drunk of this water many times. I am an agent for the sale of the manure. I consider the whole process the best that I have seen.

Mr. MICHAEL: But they are going to abandon it at Leamington.

Witness: I will explain that. Leamington had an injunction against them for polluting the river when they were using the lime process. They then tried to get land for irrigation, thinking there was no other way, but the neighbouring landowners refused to sell. One promised them a notice of injunction if they attempted irrigation. Lord Warwick, I think, in the midst of their difficulty, offered to take the sewage off their hands for 30 years. This offer was at once acceded to, and two years ago an agreement was made to sell the whole of it to his lordship for 30 years, at £450 a year. The A. B. C. Company about eighteen months ago applied to the local board for the use of their works as an experiment, and they are using them until Lord Warwick takes the sewage next March. I have never seen any ammonia added, except in one instance, and I believe that was by accident.

Re-examined by Mr. LITTLER: It is the practice not to put ammonia in at all. Although I am an agent in the sale of the manure, I have lost pounds by the interest I have taken in it. The system is to be abandoned entirely, in consequence of the board's contract with Lord Warwick. Except for that, I believe they would go on with the present works, and in a manner satisfactory to the town.

MONDAY, JUNE 27.

Mr. *Philip Ovenden*, examined by Mr. RODWELL.

I have been in business as an architect and engineer for many years. In the early part of the present year I was consulted by the managing directors of the A. B. C. Process Company, with a view of advising the Native Guano Company upon the construction of some manure works. I am now one of the permanent officers of that company. The works at Hastings have been carried out under my superintendence. The population of Hastings is about 30,000. When I first went there in February there was a large tank, which had been constructed by the Local Board of Health to receive the whole sewage of the town. It was used for storeage purposes at high water, and was opened at ebb tide, the sewage being allowed to run into the sea. I adopted that tank in constructing the A. B. C. sewage works. In addition to that I required a piece of land, one-sixth of an acre in extent. The works were completed and in operation in eight weeks from the time when the first works were formed. I have provided for the sewage of 40,000 people. The average discharge is about 1,250,000 to 1,500,000 gallons in a day of 24 hours. The whole of this sewage is deodorized by this process in that period. The water is left clear and innocuous. The residuum is pumped up into the building; it is turned into centrifugal drying-machines, which are known as hydro-extractors. A pipe extracts the water and turns out the mud in a very solid condition. There is a revolving sieve, the sides being constructed of wicker basket-work, and the solid matter (of which we get from 6 to 8 tons a day) is left in the mud. As soon as it comes out of the machines it is sprinkled with sulphuric aid, then it goes on to the upper floor where the drying is finished, and it is sent away in bags in about four days. We have more orders for the stuff than we can execute. We charge £5 per ton to any station in England, or £4 15s. if fetched away from Hastings. We apply nothing to it except sulphuric acid, which fixes the ammonia.

By the COMMITTEE: The A. B. C. process comprises the precipitates—they are clay, blood, animal charcoal, and so on. The matter precipitates and coagulates.

By Mr. RODWELL: The blood produces more than the mechanical effect of collecting and sending them to the bottom. If it is not applied we lose a great deal of the ammonia. We use about 2 gallons a day for the 7 or 8 tons, which is about one-half per cent. on the sewage. It forms 10 per cent. of the whole manure. The works cost £4200. We pay nothing for the land; it is the property of the town. We employ this system under somewhat favourable circumstances. There was a concession of the sewage made to Mr. Rock, and we then entered into a contract with him, by which we took his concession upon the same terms as those upon which he obtained it. If we had to construct a tank the cost of the works would have been £6000 at the outside. Since we have been in operation the weather has been unusually hot and dry, but I have heard no complaints of any disagreeable effluvium from our works. I do not know a town where this process is not adaptable. The fertilizing properties of the sewage are preserved by this operation. I agree with Mr. Caswell's evidence as to Leamington.

Cross-examined by Mr. VENABLES: I do not answer for the condition of their effluent water beyond its brightness and freedom from smell, as I have not analyzed it myself. The proportion (after the action of the hydro-extractors) that runs off may be one-third of solid in two-thirds of water, or *vice versâ*. I cannot estimate the correct proportion. The water after coming from the hydro-extractors is black. It goes through the extractor, it runs through the tank, and it is run out of the extractors a second time, and is treated as if it was fresh sewage. It is deodorized a second time. It does not run into the sea in its black state. It runs in at the incoming end of the tank. This mud or water runs in and is treated precisely as if it was fresh sewage—it mixes with the sewage as it goes in. The Hastings manure has been analyzed, and was found to contain about 3 per cent. of ammonia. We have made about 60 tons of manure altogether. On Saturday 4 tons 12 cwts. were turned out of the machines—the result of half a day's work. We began about six weeks ago. I did not hear Dr. Odling's evidence.

Re-examined by Mr. RODWELL: The Leamington works are in a populous and popular part of that town, and if they had any disagreeable effluvium it is just the place to challenge attention.

Dr. *Henry Letheby*, examined by Mr. RODWELL.

I am professor of chemistry in the London Hospital, and medical officer of health to the City of London. I examine the water which is supplied to London for the Association of Medical Officers of Health. I have examined the East London and the New River Companies waters monthly for six or seven years, and I have never found sewage in either. The sewage of Hertford undergoes this process, and is sent into the river. The oxalic acid sent into the river from the great straw plait manufactories at Luton operates rather as a purifying agent than as an injurious one, because it combines the lime and would improve the water. I have examined the different processes used in various places for deodorizing sewage. I went to Aldershot on Sunday, the 1st of May, the occasion spoken to by Mr. Eggar. The sewage was then coming from the tanks by two outfall sewers to the head of the farm; it ran from a common channel to a sort of straining-tank, from which it was delivered into carriers through the ground, and a small portion, at the lower part of the farm, and at levels below it, was running over the farm, but the greater bulk of the sewage was running into the Blackwater stream. I had seen the Aldershot farm before, and I was very much astonished. Those channels were permanent ones, and had not been temporarily opened, and the condition of the Blackwater River at the outfall of those channels showed me, from the quantity of the material silted up there, that it was a common thing for the sewage so to run. The farm is treated with a most unusually strong sewage, and the consequence is, that although the ground is very porous, the sewage does not percolate very rapidly, but it accumulates, particularly in the lower parts of the farm, and makes cakes of excrementitious matter which are washed into the neighbouring ditches. Some people living on the borders of Military Road, which divides the lower part of the farm, told me that at times the nuisance was unbearable. I confirm Mr. Eggar's evidence. I have never visited any of these sewage works without perceiving the smell on the ground, and frequently an offensive odour also in the neighbourhood. When I was before the House of Commons, I was not then in a position to contradict the statements which were then made, but I have since made myself master of the facts. On the 27th of April I accompanied Mr. Hawksley and Mr. Eggar to the Norwood and Beddington farms, the latter of which is a porous ground. The effluent water from both of the farms at the time of our visit was tolerably clear; but the ground was soaked with sewage, and was smelling very badly. We went to Banbury on the 20th of April. We found there sewage running upon the ground as usual, and a cultivated rank grass, but the side ditches were evidently receiving sewage which had either been run over the ground or through the carriers all the way down to the railway, and the side sewers were in a most offensive condition. There was only one house in the neighbourhood, and the woman residing there said at times it was scarcely possible to live in the house. She did not know our object. In certain conditions of the atmosphere, when the sewage is not deodorized, it is most offensive at some distance. We found a very well-managed sewage farm at Rugby, but at the lower outfall where the stream runs parallel with the river—although the water at the end of that outfall or stream was pretty good from analysis, yet we took another sample running in at the other end of the carrier, and it was very bad indeed—it was not much better than the sewage. I visited Warwick, and found things in a terrible state. There is no doubt that sewage can be purified by means of the land, but the question is whether that is really and practically done, and whether it does not require so much attention in carrying it out that it is not practically accomplished. My experience of irrigation schemes is that they are not certain, they are not economical, and they are not sanitarily safe. I do not believe that sewage, however treated, is ever profitable. I look upon the irrigation system as one of the most dangerous things which can be largely sanctioned in this country. I visited, on the part of the Metropolitan Board of Works, most of the towns in England where sewers were disposed of, 10 years ago or more, and I found that at Leicester, where they were precipitating the sewage with lime and filtering it (dealing with it much better than they have done since), they so purified the water that the river was very different. As far as my experience goes, precipitation of the sewage is preferable by some cheap and easy precipitating agent, such as sulphate of ammonia, made from the oil of the neighbourhood, which would clarify the sewage. Intermittent filtration will so purify the water, that it may be safely delivered into the stream without danger in any way to the stream or to the public health.

By the COMMITTEE: I consider the water supplied to London excellent, and quite satisfactory for drinking purposes.

By Mr. RODWELL: Dealing with Blackburn, where the water is not required for drinking purposes, I have no doubt there are simple means by which the sewage might be dealt with. The A. B. C. process is a very good process for filtration. The only means which I would suggest is the adoption of chemical processes of deodorization and subsequent filtration. We have from two to three tons of measly meat every week in London. Any one can detect measly pork, but measly beef and mutton can only be recognized by a man who is accustomed to it. That is the source of tape-worm. Every tape-worm found in the human body has come from such meat, and what is in the meat has come from eggs discharged from the human body. At the present time it is a mere accident for an animal to get hold of the excretions from the human body.

By the COMMITTEE: This germ is no doubt destroyed by cooking to a large extent.

By Mr. RODWELL: By distributing meat fed upon this source of food to the public to eat would be the only means of propagating that disease; there is no other way in which it can come back to man except by being fed upon that animal. The disease is comparatively rare, but in every town in England, if these animals are fed upon this sewage, we must be sure to have a serious condition of things with regard to this disease.

By the COMMITTEE: There is more danger in putting this sewage on the land than by farm sewage. After a week the decomposition will kill the ova of farm sewage, but the ova which has been primarily discharged from the human body will still live, whereas in the ordinary farm matter it is killed.

Cross-examined by Mr. VENABLES: As a matter of fact I cannot trace the propagation of this disease in any case to animals fed upon a sewage farm, nor can we trace other diseases of a parallel kind. I have no doubt that pleuro-pneumonia is capable of creating great affections in the human body, such as carbuncles, &c. In England we have never traced the effect of food upon the human body. In Ireland, where it is the habit to throw the fœcal matter into the yards, you have the measly pork and the tape-worm passed into the man. The pigs eat that fœcal matter and give it back to the man, and the man gives

CHARTERED GAS COMPANY.

BECKTON WORKS.

PURIFYING HOUSE

Nº9

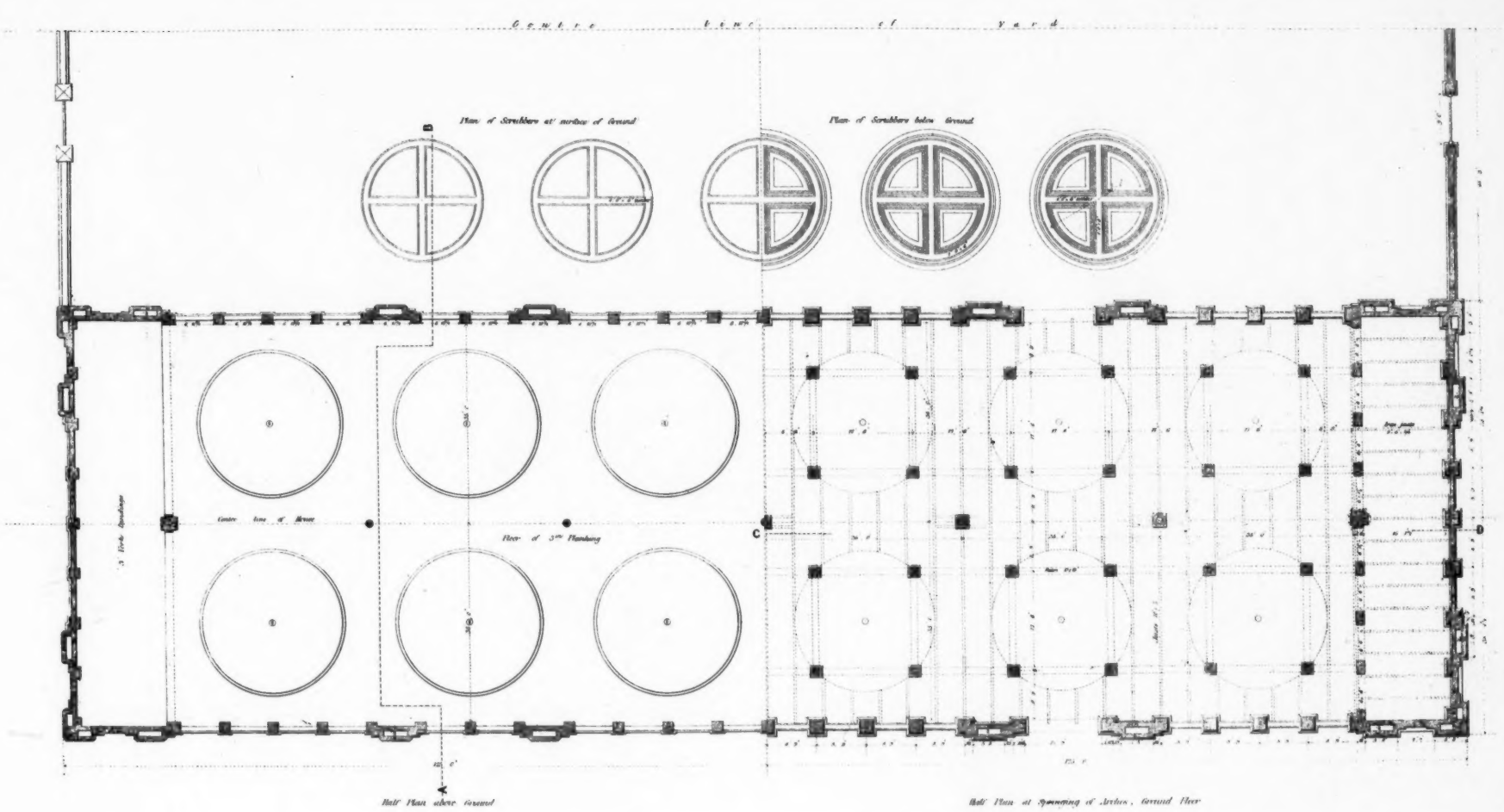

Centre line of yard
Plan of Scrubbers at surface of Ground
Plan of Scrubbers below Ground
Centre line of House
Floor of 3rd Flooring
Half Plan above Ground
Half Plan at Spreading of Arches, Ground Floor

Photo-Lithographed by Whiteman & Bass, London

it back to the pigs. I have at no time traced this connexion in Edinburgh. At Hertford the filter is cleaned every day. If the filtration were carried out in the way Dr. Frankland suggests, I have no doubt you must have a large acreage, but if they are frequently cleansed a small amount will do it, after doing what you can by precipitating agents. The filter at Leamington has entirely broken down. Filters are not always conducted in the best way, and a break down may arise from want of proper management. If by any process of precipitation you can, by the addition of valuable manures get the farmers to take the sewage matter at a very small profit to you, there is then a sufficient return for the management of such works. The ammonia in it would be a product and not an educt, but it is not worth considering. I have used the words, "There is no doubt that you may purify sewage admirably by means of land." I would allow about an acre for every 100 people for actual working. The land will become clogged, and will afterwards require to be used for the cultivation of other things than rye-grass; it must therefore lie idle, so you will want the land to be idle. I heard Mr. Hope's list of products, and he may grow them. I have heard of strawberries being largly produced by sewage. At Birmingham there was a small piece of land for experimental purposes. The great body of the sewage goes to sediment-tanks, and is not properly tried on the land, and I could not tell what quantity of sewage went upon the land. The farmers took it when they wanted it, and the neighbouring ditches were in a frightful state; some of the ponds were ponds of sewage. I have not examined the water at Hertford or Luton. In the water of the New River there are certain indications of previous sewage contamination, such as nitrates and nitrites, which are quite innocuous. If you filter sewage through land which is not occupied by a growing crop it will be converted into nitrates, and will go into the river and be drunk, and, so far as I know, there is no harm in it. At Oxford, I believe, no system is adopted; the sewage is simply discharged into the river. The result is we find vegetables and animals in the river. I do not think it does much harm, so far as our London water is concerned, but I do not say it is the right thing to do. At Ealing, before the sewage was precipitated, I did not find that it fouled the waters of London.

Mr. VENABLES: It seems to me that Oxford and Ealing do just as well without any chemical process.

Witness: They do not as regards the condition of the river where the sewage is discharged, but as regards the conditions of the water many miles away, nature takes care that it shall do no harm, because fish eat it, and vegetables feed upon it.

By the COMMITTEE: There is no doubt that the distance from the point where the sewage is discharged into the river has much to do with the purification. Water undergoes purification by passing along.

Thomas Spencer, Esq., examined by Mr. LITTLER.

I am an analytical chemist, and have had very great experience in sewage and water matters. I am the chemical adviser of the Liverpool Sewage Irrigation Company, who obtained their Act in 1866.

By Mr. VENABLES: Those works are merely projected, but from my experience I always believed that sewage irrigation works are not the best means of getting rid of the effect of sewage. In the case of Liverpool I recommended irrigation because Liverpool is entirely exceptional. We had a large estate, almost entirely consisting of sand and peaty matter, given to us by Mr. Ince, of Blundell, and, on the other hand, when we were not disposed to use the sewage, it could be turned into the Mersey without any one finding fault.

By Mr. LITTLER: This will be a good place for carrying on sewage irrigation. It would probably be successful, provided they had a ready market for the rye-grass, which cattle (but not horses) eat. In 1850, Professor Way and myself made separate analyses of the London sewage. The professor made the value amount to over 2d. per ton; my amount was 1d. and a very doubtful half farthing. Professor Way afterwards repudiated his analysis as indicating the London sewage, as he found that the sewage given him was not from the outfall as mine was, but from a court in Oxford Street. The value of the sewage of a town like Blackburn is very small indeed. The value of Liverpool sewage is abnormally large; there is an amount of potash in it which I have never found anywhere else. I am sure that 1 grain of potash is worth more than 2 grains of ammonia. I was at one time chemical adviser to the New River Company, and I never found any nuisance outside the walls of their works at Hertford. I have constructed a large number of purifying works, now in operation, and they are paying commercially very well—from 8 to 9, and some 10 per cent. I allude to waterworks from sewage water. I constructed the purifying works at Wakefield. The water supply comes from the river Calder, which contains the sewage of 70,000 inhabitants, and the refuse foul water from woollen and other works. Sometimes the river is as black as ink. I filter it by a peculiar process, which I have introduced, and which has been exceedingly successful. The first filter-bed has been in operation seven years. We allow one filter to lie fallow while the other three are at work. The one lying idle is cleansed, the surface scraped off, but the interior of the cleansed filter has never been touched, and we have never taken off more than ¾ inch from the surface; and it has been examined, and is as perfectly sweet 3 or 4 inches in as at 3 or 4 feet. It is a very shallow filter; all the apparatus does not exceed 3 feet 6 inches. In a great drought the impurity of the Calder is quadrupled. This system was so successful in the dry season that Wakefield was the only town in England which was not put upon short allowance. The water is exceedingly good and pure. It was sent to a great many chemists, who reported invariably in its favour; some of them could hardly believe it was river water, and suggested it must be spring water. It is used at the County Lunatic Asylum, and the commissioners have reported that the death-rate there is very much smaller than it ever was before the introduction of the purified water. Dr. Frankland admitted "that the filtration of the town's (Wakefield) water produced it at a degree of purity that was really marvellous." Of course, I valued that as coming from Dr. Frankland, because he had always said it was nonsense, and never could do. The main purifier is protoxide of iron, mixed with sand. It is called magnetic oxide, and it is obtained by roasting the iron ore in a particular way, and getting it highly magnetized. By keeping the ore for eight or ten hours at a cherry-red heat, an atom of hematite is driven off, the absence of which gives its value, and the product is what I have used for a great many years.

By the COMMITTEE: I was not examined before the commissioners who were appointed to inquire into the means of preventing the pollution of rivers. I was asked to give evidence, but as soon as I sent in my abstract I was altogether ignored. I could only think that the reason why I was not examined was because my evidence would have been against the foregone conclusion of the committee.

By Mr. LITTLER: I have also tried this system at Rugby, Spalding, and several other towns, and am satisfied it is a success. At Blackburn the water is not wanted for drinking purposes, and they would require to spend much less than at Wakefield in order to clarify it. At Wakefield we have four filtering-beds, the aggregate superficial area of which is about 2600 square yards, out of which we can obtain when all are at work about 1,200,000 gallons daily. But making allowance for the diminished rate at which filter-beds work when their surface begins to need cleansing, we calculate on a constant million gallons of filtered water daily. Applying this to the sewage of Blackburn, and taking its maximum at even 2 millions daily, it would then require not more than 5200 yards of filtering area, or less than an acre and a quarter, to filter the whole of that sewage. I have taken it for granted that they will use a precipitating process; but even if they did not it could be done, but it would be done far more easily and at less expense by precipitation, and the precipitated product would be for sale. As soon as my deodorizing process is sprinkled upon a cesspool the noxious effect is gone.

By the COMMITTEE: In a cesspool of two yards, perhaps half a foot of the material would prevent any smell; 100 lbs. of it costs 3s. or 4s.

By Mr. LITTLER: When it comes to the filtering-bed, there is no nuisance to the neighbourhood. The material itself never requires renewal; it acts upon the organic matter in solution in the water, all the matter in suspension being interrupted; but all the organic matter in solution may be taken out, although we do not find it necessary to have a thickness in the filter, which would take out the whole of it, but we take out all that is putrescent. It is a mere question as to the thickness of the filtering-bed. At Southport they have not required a single ounce in addition to what I put into their beds 10 or 11 years ago. I have been consulted several times lately by Boards of Health, and I have uniformly recommended filtration by precipitation.

By the COMMITTEE: There is a precipitation process at present in use at Blackburn.

Cross-examined by Mr. VENABLES: There is no reference to my process in the report of the Rivers Pollution Commission. I have applied it to the filtration of sewage at Warley and another place in Essex where the East India Barracks used to be. Sir Digby Wyatt was the Government engineer, and he was served with an injunction to stop the introduction of the sewage into the adjoining river. He applied to me, and I gave him what instruction I could with regard to making a good many filter-beds. He did so, and he has never since heard of the injunction. My system is not at present employed to get rid of sewage in any place in England. I should think there is a daily flow of 40 million gallons in the Calder, and 1 million gallons of sewage.

Mr. VENABLES: Does it not strike you that it is rather a different thing to filter the sewage pure and to filter sewage where it only forms 1 part in 40 of the liquid?

Witness: Yes; but in sewage water after precipitation you do not want it so pure as when it is required for drinking use in a town and for other purposes.

By Mr. VENABLES: At Wakefield we have a very large subsiding reservoir of, I dare say, 2 or 3 acres. We have from four to six times the area of subsiding-tank which we have of sewage. I do not think subsiding-tanks would be of great use as applied to pure sewage, unless a chemical precipitant were added to them. I have analyzed some of the A. B. C. manure, and have sometimes found it worth 30s. and sometimes less. If I used sand with no admixture of iron it would be of no use whatever, except to intercept mechanical impurities.

John Fowler, Esq., C.E., examined by Mr. RODWELL.

I have considered the questions of irrigation and precipitation in reference to the sewage of towns. I have visited Barking, where you cannot but be cognizant you are in the neighbourhood of a sewage farm. I have no abstract objections to sewage farms; it merely depends upon the circumstances. I have examined the works at Ealing, at which place a small quantity of the sewage is dealt with in rather a clumsy way by the lime process, and subsequently by filters. It is, however, quite sufficient to show that the whole of the solid matter can be got rid of. At Leamington I made a very careful examination of the A. B. C. process. Undoubtedly the process is perfectly effectual for separating the solid from the liquid matter, producing a solid matter of value and the effluent water free from objection. I think the same process, or some improvement on it, might be adopted at Blackburn. Certain little improvements might be made. As is natural upon a first experiment, the system may be applied to any town where the circumstances of the surrounding country do not admit of the proper application of sewage irrigation to it. For instance, if it were not in the neighbourhood of a town, and were sufficiently far from it to be from objections as regards the population, either existing or possible, and where the land is of a sterile character, I think that the application of the sewage would possibly be most beneficial. I know Blackburn. There is no part of Lancashire or of Yorkshire that I have met with where the sewage of towns can be safely or properly dealt with by irrigation. It is necessary in all those cases, having regard to the good of the towns themselves and of the public generally, that you should separate the solid from the liquid matter by some such process as has been used at Leamington. At Leamington we have a very satisfactory basis on which to form an opinion as to the disposal of sewage, because the chemical precipitates, in order to separate the solid from the liquid matter with rapidity, seem to me very successful. The filtering process there is incomplete in area. The first thing is to precipitate as large a portion of the solid matter as possible, for two reasons—first, that you can get a valuable product which should not have been wasted; and secondly, you get the product in a short time. At Leamington the A. B. C. process is an exceedingly good one as regards that purity. I think the process of simple filtration should be made as pure as possible, and much more perfectly than at Leamington. But that is a matter of detail; there is no mystery or doubt about it. The great difficulty was the precipitant, and that difficulty being got over, the other is a very simple matter. Mr. Spencer's process is a most valuable one, but I should only approve of it in the case of sewage, where you turn effluent water of small quantity into a river of large quantity; and where you do not want it immediately for the purpose of drinking, you do not want the same system of purification of sewage. In some of the dyeing and bleaching operations in Lancashire it is very desirable to have the water as pure as possible, and the manufacturers would be glad to buy pure water. The proposed Blackburn land is much too near Preston for irrigation, and is much too valuable, and too liable to be built upon. It is a wrong thing both for Blackburn and Preston. I have made a trial of the A. B. C. process in my garden, but whether it will be worth the £3 a ton that they have charged me I could not say. I have tried it very carefully indeed, and certainly it is excellent manure; that was Mr. Spencer's process.

By the COMMITTEE: One in 240 would be a very good fall for sewage.

Thomas Hawksley, Esq., C.E., examined by Mr. RODWELL.

My attention has been particularly directed to the Blackburn irrigation scheme. I know Mr. Petre's land well, and the scheme in question would have a highly detrimental effect upon it. I give my opinion with a thorough knowledge of what takes place upon other irrigation farms. I have visited nearly all the farms in the kingdom. I went to Aldershot with Dr. Letheby. The water was flowing off the land in an exceedingly polluted condition. In the river itself, at three or four different outfalls, there are little deltas of sewage mud formed, showing by their accretion that it was the ordinary condition of things. The land was clogged very extensively with the sewage deposited upon it. The mass so deposited had become green, and in some places where it was drier than others it was curling up like brown paper. Altogether the circumstances were exceedingly unfavourable with regard to sanitary influences. I know the town of Blackburn, the sewage works, the river Derwent, and all the streams flowing into it, and I own that sewage irrigation in that locality is a mistake. There is no difficulty in the purification of water by different kinds of precipitating, if they are properly employed. Many of these precipitating processes have failed because town authorities are so niggardly, that in general they put the process, which is essentially a chemical one, into the hands of a labourer at half a crown a day. At Hertford the process is a success because it is conducted, not by a town authority, but by the New River Water-Works, who are under very severe penalties if they allow any dirty water to escape. I look upon the irrigation scheme as sanitarily injurious. The precipitating process does not inflict the great injury upon the landed proprietors which the irrigation process does, for you may do as much upon two or three acres by the precipitating process as upon a square mile by the irrigating process. Notwithstanding irrigated land is said to produce crops which are sold at £18 to £25 an acre, it costs £30 or more an acre to get the £25. When the land is acquired for the purpose of purifying the water in an ordinary sense, an enormous quantity becomes necessary. Taking into account the ploughing up, one acre of land to every 50 persons is wanted.

Photo-Lithographed by Whiteman & Sons, London

Unless that quantity of land be obtained, and unless the water be so carefully distributed at all times of the year and under all circumstances (which is scarcely possible to do), so that the whole of the foul matter—the putrescible matter—can be taken out of it, the thing is a failure. If such a large quantity of land is wanted, it becomes a commercial failure also, and there is no case in which there is one profitable concern where the land is used for sanitary purposes.

Cross-examined by Mr. VENABLES: In winter, when the oxidation goes on more slowly, and when there is less evaporation, a much larger portion of the land must be covered with sewage than in summer. It must be done in rotation.

Mr. VENABLES: Practical witnesses say that upon land of this extent 18 or 20 acres would be under the sewage at the same time, and therefore producing any evils which sewage may produce.

Witness: Then I say that from those 18 or 20 acres the water would not go off in a pure state.

By Mr. VENABLES: The nuisance would not be confined to those 18 or 20 acres, because the object is to enable the effluent water to go off perfectly purified into the river. In my evidence in the House of Commons I said, "There is a good deal" (meaning a good deal of nonsense) "in this A. B. C. process, and the particular mixture used there, I have no doubt, especially in the great number of things they employ—nine or ten mixed up together. . . There is a great deal of nonsense, but it acts partly chemically, partly mechanically. All that is perfectly explainable. Some of the other things may, perhaps, contribute to the value of the measures, but they do nothing for the purpose of clarifying or rendering pure the water itself."

Mr. VENABLES: And consequently, I suppose, a good deal of the value of the manure as it comes out is due to these materials which you say, for the purpose of clarification, are all nonsense?

Witness: No; they simply become vehicles for other very good things which are put into the manure after it comes out of the tank, and that is one of the most important things to be considered.

Mr. VENABLES: It is the vehicle used, then, but the valuable parts of the manure are put in otherwise?

Witness: Not all the valuable parts of the manure, but those which enable the manure to be used in the same way as you would use guano.

Mr. *J. T. Harrison*, examined by Mr. RODWELL.

I am a civil engineer, and have had great experience in this town sewage question. I was on the first Rivers Commission, in 1865. My colleagues were Mr. Rawlinson and Professor Way. My attention has been directed to this plan of having sewage irrigation works upon Mr. Petre's property, at Blackburn. I think it would be decidedly injurious to that property. I have visited a great number of sewage irrigation works, and have come to the conclusion that if they are not properly conducted they are sanitarily injurious. If they are properly conducted they are not injurious. I have hardly met with a single case in which they have been properly conducted. It is a great difficulty to keep them clean. I think the wisest thing for Blackburn to adopt is the mode recommended in the last report of the Rivers Commission upon the river Mersey—viz., some system of chemical deposition, combined with a system of intermittent downward filtration. That is the process referred to in Dr. Frankland's report. I have carefully examined his experiments, and I see that the water which issues from the irrigated farm quite carries out his laboratory experiments, and I believe it would be a thoroughly successful system. I believe that at Hoghton Bottom they have a filter of a very great depth, which might be used for the purpose. The report says that after the chemical process one acre and a half would be sufficient for filtering and purifying the water so that it might be passed into any stream. It first of all says that it requires one acre for 3300 persons, and then further on the objection is raised that "the previous treatment of the sewage by one of the chemical processes already described would, however, obviate this liability to nuisance, whilst it would probably reduce by one-half the size of the filter necessary for cleansing a given volume of sewage." That would be one acre for 6000, or one acre and a half for 10,000 persons.

By Mr. VENABLES: It says 5 acres afterwards; that is a contradiction of the commissioners. I cannot explain that.

By Mr. RODWELL: There would be no necessity in this case to make filter-beds; there is a natural deep bed of sand, and it would be only necessary to spread the sewage over the area of that land, and it would sink into the land, and the purification would become complete. I do not think Mr. Rideout's system at Bolton would purify the sewage; it would certainly clarify it, but I should not be satisfied with simple clarification. The commissioners in their report say, "An inspection of these results show that all the classes of process are to a great extent successful in removing polluted organic matter in suspension, for if we exclude the sample of sewage treated by lime at Blackburn, where, as we have remarked, the process is carried on in a very careless manner, there are but few instances in which the result is not satisfactory." That would imply that if at Blackburn it had been properly managed they would not have been obliged to come to Parliament, because Mr. Rawlinson apparently would have satisfied the Chancellor that they were doing all they were required to do. I do not think that I should have been satisfied, for I am a greater stickler for purification than Mr. Rawlinson. My process would both clarify and purify. The most favourable cases that are mentioned here of the application of sewage to the land only show a return of 4s. per head for each of the inhabitants, and those are cases where the towns have a water-closet system. Taking the 80,000 inhabitants of Blackburn at 4s. per head (supposing they converted all their water-closets), they could only look for £16,000 a year. The expenses attending the management of the farm, independent of rent, vary from 40 to 50 per cent. upon the receipts; 40 per cent. upon the £16,000 would make £6400 as the expenses, leaving under £10,000, which would not be 10 per cent. upon the sum they are about to expend. If that were the result, it would land them in a serious loss.

Cross-examined by Mr. VENABLES: The commissioners report states that "the town authorities of Luton are under a perpetual injunction, obtained against them by a wealthy landed proprietor in the neighbourhood, which prohibits them from casting their sewage into the river unless it has been first treated by lime. The people of Luton have carried out the injunction strictly, and have remained safe. The New River Company, which, as already stated, subjects the Hertford sewage to the same process, and in a still more careful manner, is nevertheless complained of, and threatened with litigation by the authorities of Ware. But in both cases the result is the same; the large sums are annually spent in vain, the effluent water remains to all purposes sewage, and, except to the eye, the sea receives, both from Luton and Hertford, almost as much sewage pollution as if that process had never been performed. In point of fact, if a river is really foul it is safer that it should look so."

Mr. VENABLES: With reference to irrigation, the commissioners in the same report say: "In our report on the Thames we have described at some length the modes of sewage irrigation as practised at Croydon, Norwood, Worthing, Carlisle, and Edinburgh. We have little to add to this account, other than that experience confirms the practice of this mode of disposing of sewage. In the course of our inquiry we have received evidence as to its advantage. At this time, April 18, there are crops of Italian rye-grass at Worthing, grown under sewage irrigation, which are being cut at the rate of from 5 to 8 tons to the acre, whilst adjoining pasture lands are almost bare. A small dairy has been established, the cows being stall-fed on cut grass, the milk produced, from its richness and superior quality, commanding a preference in the town. A sewage farm requires special and peculiar management; the operation should be specially adapted to this mode of culture, and then it will be found that any land may be improved. The operations do not turn clay lands into swamps, although 60 inches in depth of sewage are added by irrigation to the rainfall. The dressing with sewage must be even, and that at regular intervals. In all cases sewage should be used fresh—that is, before putrescence has set in—so as to prevent any effluvium arising from the irrigated land. When this is the case there cannot be any just cause for complaint."

Witness: I do not see any great reason to find fault with that passage. I believe now the proper course would be for towns to be obliged to clarify their sewage. If it were clarified by some chemical process first of all, I do not see that there will be any great objection in sending it anywhere over the country; but I do not think that towns are bound to utilize their sewage upon land any more than they are bound at any time to utilize their nightsoil upon land. They are bound not to have the nightsoil about the town so as to be a nuisance. The farmers use it, and the sewage they are bound to deposit so as not to be a nuisance to their neighbours, but I see no reasons for making towns agriculturists. I am quite sure that until it gets into the hands of the towns to manage the sewage it will never be managed properly.

By Mr. VENABLES: When I find a nuisance existing I attribute it to carelessness. All the evidence our commission received went to the point that there was no other mode of purifying the sewage but by irrigation upon land, therefore I was the most strenuous of the commissioners in advocating irrigation, and I should be to this day but for this report, which shows an alternative means. Dr. Frankland recommends filtration in some small towns, but not in Blackburn. I say distinctly the adoption of the irrigation scheme is not the choice of the town. Dr. Frankland has, in evidence, recommended that filtration should not be tried except for very small towns. The experiment of this would tell much worse in a laboratory than on a large scale out of doors, because it is a question of the aëration of the soil, which would be more likely to be more complete upon a large surface than in a small laboratory. I found a lot of crystals in the A. B. C. process at Leamington. I understood they were sulphate of ammonia. I have no doubt they did not come from the sewage. The value of sulphate of ammonia is about £16 or £20 a ton.

Re-examined by Mr. RODWELL: I believe ultimately, when they use chemical processes to the sewage, they will add to it manure of a valuable character, so as to make the sewage simply the vehicle of a much more valuable manurial agency. The value of the sewage of one man is reckoned at 8s., and the value of 100 times 8s. to be placed upon one acre would be perfectly absurd. At Ealing, where simple filtration is used, the ammonia in the sewage goes on at 7 in the 100,000 gallons; it comes off at 4·2, leaving 2·70 parts by a simple filtration, so that there is a lot of ammonia in the solid matter, and I am not at all prepared to admit that the matter will prove valueless when put upon the land.

(*To be continued.*)

Miscellaneous News.

MAURITIUS GAS COMPANY, LIMITED.

An Ordinary General Meeting of the Members of this Company was held at the Offices, 39, Old Broad Street, London, on Wednesday, Sept. 7—W. WHITE, Esq., in the chair.

The SECRETARY (Mr. A. Hersee) read the notice convening the meeting, and the following report of the directors:—

In presenting their first report, the directors congratulate the shareholders on the successful and complete formation of the company. The applications for shares were considerably in excess of the number available, and the whole capital was promptly allotted to a highly satisfactory and substantial list of proprietors.

On the 13th of May last Mr. Mellor, the consulting engineer of the company, proceeded to Port Louis to examine and take over the property, and the directors are happy to report that he found the works and plant in excellent condition, and fully equal to the expectations formed.

The concern was transferred to the company on the 29th of June last, and it has since been carried on by your directors. From the experience of the working hitherto, they are confirmed in their belief that the enterprise will afford a profitable return on the capital invested.

The directors have to report the formation of a resident committee of three gentlemen of position in Port Louis, in whom the authorities and the public will have entire confidence, and they have no doubt the influence of these gentlemen will be heartily exerted in promoting the welfare and progress of the company.

The directors have engaged as manager, Mr. E. H. Salisbury, of the Manchester Gas-Works, a gentleman of experience, and he will leave for Mauritius by the ensuing mail. Arrangements have been made for the proper management of affairs in the meantime.

Negotiations are already in progress for an extension of the public lighting, and orders have been received for many additional private lights. The fitters are fully occupied, and there is every reason to believe that the operations of the company will continue to make satisfactory progress.

Shipments of coal have recently been effected, both from England and Australia, at rates within the estimate, and the directors are satisfied that their calculations as to the cost of coal will not be exceeded.

The instalment of £1 per share, which will become payable on the 1st of November next, will provide not only for all liabilities at present incurred, but also the necessary outlay for a considerable time.

The CHAIRMAN: Gentlemen, the report states pretty clearly, I think, everything that has taken place in connexion with the affairs of the company. You are called together to-day, in accordance with the provisions of the Act of Parliament, to receive this statement of our proceedings, and I think you will agree with me when I say that all those proceedings will bear the fullest investigation. The company was incorporated on the 7th of May, the prospectus was issued on the 12th, the list of applications was closed on the 23rd, and the allotment of shares was made on the 26th; so that no time was lost in these necessary preliminaries. I may mention, too, that every share was allotted, and that we had applications for considerably more than we had power to issue. The list of shareholders is a highly respectable one, and I believe the great majority of our shareholders have taken the shares entirely for investment. As the report states, we sent Mr. Mellor out to Port Louis to look at the works, and see if everything was as it had been represented to us. The report which we received from him was highly satisfactory. He assures us that the works are very substantial, and that, with a few unimportant additions, they will be amply sufficient for some years to come. The authorities at the Mauritius have given the company a most friendly reception, and the directors feel that one of the best things done by Mr. Mellor, after taking over the property, and seeing that everything was correct, was the formation of a resident committee at Port Louis, composed of gentlemen of high standing in the locality, so that, not being on the spot ourselves, we shall have our affairs looked after by those who will take an interest in them. The position of the company is therefore settled, and we have every reason to believe that our business will be thoroughly looked after. As the report informs you, we have appointed as our new manager a gentleman who has had something like 16 years experience in the Manchester and Chester Gas-Works, and we look upon it as a very suitable appointment. When in Mauritius, Mr. Mellor put the arrangements for extending the public lighting in a proper train, and, in fact, before he left, orders were pending for the supply of additional street-lamps. The demand for gas is extending, and we have no doubt it will be largely used in private houses. The quantity made last year was 10,500,000 cubic feet. For the first six months of 1870 it was 6,260,000, showing an increase at the rate of something like 20 per cent. With regard to coals, I am happy to be able to tell you that we have sent coals from this side, and have also bought some Australian coal at a saving upon our estimate. The call of £1 per share, which will become due next November, will, we presume, last us for the next nine months. Our prospects we consider very encouraging, and the directors hope—and, indeed, have very little doubt—that the result of our operations will be, when we come to make up the accounts

in April next, the declaration of a satisfactory dividend. I now move—"That the directors report be received and adopted."

Mr. LEWIS CUBITT seconded the motion.

The CHAIRMAN, in reply to several questions, said there were no shareholders in the Mauritius; in fact, the company had no shares to offer to investors there. The resident committee, therefore, were not members of the company. One of them was a gentleman connected with the bank where all the moneys of the company would be kept.

Mr. STOKES asked Mr. Mellor to point out on the plans the site of the works, and to give an opinion as to their eligibility.

Mr. MELLOR said the works were situated by the side of the harbour, and he considered the site to be as good a one as could be selected. It was sufficiently far from the town to prevent any complaint of nuisance; it was favourable for the landing of coals if the directors thought fit to erect a jetty, the concession for which he obtained from the Government when there. The works were very substantial, being built in stone; the walls of the retort-house were 3 feet thick, so that they would resist the force of any storm that might arise. The capacity of the works was greater than absolutely necessary, which was a fault in the right direction.

Mr. STOKES expressed his satisfaction at the appointment of a local committee. He attached much importance to that arrangement.

Mr. FRANKLIN asked whether the directors could form any estimate as to the future cost of coal.

The CHAIRMAN said they had reason to believe that they would be able to make an arrangement with the Australian Agricultural Company, to whom the coal mines in that colony belonged, to supply coal at a moderate price, and Mr. Mellor reported that the quality of their coal was equal to that obtained from England.

Mr. ORR said he understood there was a number of small hamlets around Port Louis which might be advantageously supplied with gas by this company. He hoped if the directors should hereafter deem it advisable to raise new capital for the purpose, they would give an opportunity to capitalists in the Mauritius to subscribe for it.

The CHAIRMAN said the matter was one which required careful consideration by the board, or it might happen, as in the case of branch railways, that such extensions, instead of being feeders to the main undertaking, became suckers. Extensions of mains meant increased leakage, and unless prudently undertaken they left no remunerative profit.

The motion for the adoption of the report was then put, and carried unanimously.

A cordial vote of thanks was given to the directors for their services.

The CHAIRMAN, in acknowledging the compliment, said many of the shareholders in this company had had experience of the directors in connexion with the Oriental Gas Company, which had proved very successful. He hoped the same result would follow here, and that on the next meeting of the proprietors the vote of thanks would be justified by the shareholders receiving something substantial on their investments.

GLASGOW TOWN COUNCIL.

The Ordinary Monthly Meeting of the Glasgow Town Council was held on the 1st inst.—the LORD PROVOST in the chair.

THE STRIKE AMONG THE WORKMEN AT THE GAS-WORKS.

The minutes of the Gas Committee, of date July 26, were read, in which it was stated that the meeting had been called in consequence of the strike among the operatives at the works, and that the Lord Provost, along with Bailie Burt and Mr. Moir, had met with a deputation from the workmen; that, after inquiry, it was found that the demands of the men were unreasonable, and therefore could not be conceded; that the places of the men on strike had been partially supplied; and that there was every probability that the whole number would in a day or two be filled up. The committee approved of what had been done, and resolved to leave it to Mr. Foulis to make the best arrangements he could for carrying on the work in the circumstances. The committee also instructed Mr. Foulis to frame such rules as he should think best for the future conduct of the work at the different stations.

The minutes were approved of.

Dr. *Revenue Account, from June 1, 1869, to June 30, 1870.* *Cr.*

To Manufacture of gas—				By Gas-rents		£210,736 2 2
Gas coals	£99,411 9 7			Residual products—		
Purifying materials, and oil, water, and sundries at works	4,077 19 6			Coke	£9,556 12 5	
Salaries of engineers, superintendents, and officers at works	2,985 2 0			Ammoniacal liquor and tar	13,972 0 1	
Workmen's wages	31,237 17 11					23,528 12 6
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour	£10,081 13 7			Waste lime, &c.		678 5 9
Less old material sold	530 7 7			Rents of house properties		745 10 0
	9,551 6 0			Transfer fees		12 15 11
Carting account	1,798 10 1					
		£149,062 5 1				
Distribution of gas—						
Salaries of surveyor of meters, inspectors, and clerks, in Survey Office	£4,404 11 4					
Repair, maintenance, and renewal of mains and service-pipes, including materials, and laying, paving, and labour	1,858 18 5					
Repairing, renewing, and refixing meters	5,388 12 11					
Miscellaneous charges	176 8 4					
		11,828 11 0				
Rents, rates, and taxes—						
Rents and feu duties	£1,428 18 1					
Rates, assessments, and taxes	5,309 7 7					
		6,738 5 8				
Management—						
Salaries of treasurer, accountant, and office clerks	£1,346 0 4					
Collectors salaries	2,093 11 2					
Stationery	776 9 3					
Printing and advertising	258 18 6					
General establishment charges	849 15 9					
Offices in Virginia Street (repairs, &c.)	110 10 8					
		5,435 5 8				
Expenses in connexion with new loans		90 10 0				
Retiring allowances to old servants of the companies		800 13 1				
Amount transferred to capital for depreciation, viz.—						
On works and pipes	£8,162 2 0					
On meters	5,746 6 0					
		13,908 8 0				
Total expenditure		£187,863 18 6				
Balance carried to Profit and Loss Account		47,837 7 10				
		£235,701 6 4		Total receipts		£235,701 6 4

The LORD PROVOST rose to move the approval of the report. In doing so, he said it would be gratifying to the members of the council, as it must be to the public, to find that in this the first year of the corporate management of the gas-works, they had been successful in accumulating a large balance of profit. They were not always permitted to know to what extent the old companies made profit, but they knew that the full dividend allowed by the Act was apportioned, yet he questioned if they had ever made at any time a larger profit than the corporation had been able to secure during last year. In the distribution of that profit the committee had paid off the entire cost of the parliamentary proceedings, and he hoped the council would approve of that. It was better that that should be done at once, perhaps more especially so when he mentioned that about one-half of the amount, or £7000, came into the hands of

FIRST ANNUAL REPORT ON THE GAS SUPPLY.

The CLERK read the minutes of the Gas Committee, of date August 25, containing the first annual report of the Committee on Gas Supply to the Town Council:—

The first year in which the supply of gas has been in the hands of the corporation terminated on the 30th of June last. The pecuniary results have been very satisfactory, the business leaving a balance of £61,745 15s. 10d., out of which £13,908 8s. has been written off for depreciation; of the balance, £47,837 7s. 10d. has been carried to the credit of profit and loss account. The annuities created by the Act of Parliament have been paid to the amount of £30,955 0s. 3d., being the total amount applicable to the past year, and the interest on borrowed money to the amount of £4890 12s. 10d.; deducting these from the balance, there remains £11,991 14s. 9d., to which falls to be added the surplus profits for the past year, amounting to £7624 10s. 5d., which makes available for other purposes the sum of £19,616 5s. 2d. It was contemplated by the Act that the whole expenses thereof, and the whole expenses of the transfer of the companies, should be paid out of money to be borrowed for that purpose, but the successful results of the year's operations, and the favourable realization of some assets of the companies not required by the corporation, have enabled the committee to pay off these expenses without borrowing any sum for that purpose. After providing for this, and a depreciation of 2 per cent. on works and 6 per cent. on meters, the committee propose that, out of their surplus then remaining, a sum of £5000 should be paid to the corporation for its general purposes as provided by the Act, which would leave a small balance of £135 17s. 5d. to be carried to next year.

As authorized by the council in the early part of the season, a new retort-house, comprising 320 retorts, has been erected at Tradeston, and one gasometer capable of storing 1,250,000 cubic feet of gas has been nearly completed there, on ground acquired for that purpose from Hutcheson's Hospital. The tank for a reserve gasometer of a similar capacity is nearly completed.

At Dalmarnock, clay retorts of a larger size and improved construction have been largely substituted for the iron retorts formerly in use there, and the result has been an improvement in the quality, and an increase in the quantity of the gas produced. It is intended to alter all the retorts in the same way.

The works at Townhead have simply been kept in working order. They are in a very dilapidated state, and your committee is unanimously of opinion that these works should be abandoned as soon as a more suitable site can be obtained for new works. Your committee have looked at several sites, and it may probably be necessary to apply to Parliament for powers.

The contracts for coal for the current year have been concluded upon favourable terms.

In acquiring ground for new works in lieu of those now at Townhead, it will be matter for consideration whether space should be acquired at the same time, to enable the corporation to take the manufacture of the residual products into their own hands when opportunity offers.

A large extent of new piping has been laid down, the old pipes having been insufficient for carrying the gas to long distances. Arrangements have been made at the same time for connecting the supply from the different works, should this at any time become necessary, by the increased power of production, storeage, and distribution, which will be ready by Martinmas, so that there will be an ample supply of gas during next winter.

The increase of consumption has been a little over 3 per cent., somewhat less than the average of former years, as shown by the following figures:—

1869.	1870.
978,323,600 cubic feet.	1,010,117,625 cubic feet.

The results above set out enable the committee to recommend a substantial reduction in the price of gas to the general body of consumers for next year, and they at the same time recommend a rearrangement of the discounts. The following table will show the present prices and the proposed alterations:—

Present Prices.			
Accounts under £4	— 4s. 7d. per 1000 cubic feet, net.		
£4 and ,, £20	— 4 7 ,, ,,	less 5 per cent.	discount.
£20 and ,, £100	— 4 7 ,, ,,	less 10 ,,	,,
£100 and upwards	— 4 7 ,, ,,	less 15 ,,	,,
Proposed Alterations.			
Price within the Municipality.			
Accounts under £100	— 4s. 2d. per 1000 cubic feet, net.		
£100 and upwards	— 4 2 ,, ,,	less 5 per cent.	discount
Price beyond the Municipality.			
Accounts under £20	— 4s. 4½d. per 1000 cubic feet, net.		
£20 and ,, £100	— 4 4½ ,, ,,	less 2½ per cent.	discount.
£100 and upwards	— 4 4½ ,, ,,	less 7½ ,,	,,

It will be observed that a difference in price is made in favour of consumers within the municipality. Your committee gave this matter very serious consideration, and they are satisfied that, as the municipality provides the funds and runs all risks, consumers within that area should be in a better position than those beyond it. A reduction, however, has also been made beyond the municipality, so as not to make the inequality excessive.

the corporation in what he might call an unexpected manner, belonging, as it did, to the surplus profits of the year before that in which they took over the management. Therefore, one-half was provided without touching the profits of this year at all. He hoped the council would approve of this also; for although it would have been quite justifiable to have put that to the capital account, yet it was better, in the circumstances, to have these expenses wiped out altogether. Then there was an appropriation of 2 per cent. on the general stock, and 6 per cent. on meters, as a depreciation-fund, regarding which he also hoped to obtain the approval of the council, because it was quite necessary that a sum should be written off yearly for depreciation. The sum thus stated was believed to be quite ample for the purpose, as it was something more than was usually applied to that purpose in works such as theirs. Of course the replacement of pipes, as circumstances rendered necessary from time to time, would be charged to revenue. The further application of the sum left on last year's profits he hoped the council would also approve of. The Corporation of Glasgow were mainly instrumental in procuring the transfer of the companies stock to themselves for behoof of the community, and he held that there was no source through which that community would get more general benefit than through their dispensation by the Corporation of Glasgow. A variety of things were constantly coming up—claims upon the corporation—which must be and were satisfied without taxation. They had all along been what might be called a poor corporation, having many claims, and no large funds to meet them; therefore he hoped it would be freely granted, as it had been from the first contemplated that any surplus arising, after everything else had been provided for, should be handed over to the corporation for corporate purposes. His lordship mentioned that in Manchester, where they realized very large profits from the sale of gas, these profits were applied in various ways for the benefit of the citizens. One proportion went to reduce the cost of water—a thing, fortunately, that did not require to be done in Glasgow, as the cost of that article had been exceedingly moderate all along, and more especially since the supply was got from Loch Katrine. The council would observe that it had been arranged to reduce the cost even below the moderate figure it stood at by 25 per cent., or 3d. a pound, and there was, therefore, no need to apply the profits of the gas to make water cheap. In Manchester they applied the profits of the gas to the improvement of the town, or, as he might call it, to the enrichment of the corporation for its general purposes. They divided their surplus profits from gas in three several sums, and their profits, he might say, had in some years even exceeded the very handsome profit secured this last year, as he remembered that one year they had as much as £54,000 to appropriate in that fashion. It was on these grounds that they made a claim for the corporation to any moderate sum that might arise in this and future years. He hoped, therefore, it would meet with the approval of the council. There were various other things referred to in the report, the most important of which was the reduction which was proposed to be made in the price of gas in the year now current. It had been found most desirable to reduce the rate on the wider area—that was to the general consumers, as they were the parties upon whom the price pressed most heavily. The price to the general consumer would, therefore, be reduced 10 per cent., or 5d. per 1000 cubic feet. The large consumers formerly got large per centages, and these would now be nearly abolished; only 5 per cent. discount upon sums exceeding £100 would in future be allowed. The large discounts reduced the price so much that it was a question if the corporation would have its own money returned. Still there was reason in allowing them some discount, for the large consumers did not tax the corporation for meters and inspection—and all those things cost money—the same as was done by small consumers. The lessening of the discounts would put both the large consumers and the corporation on a more just and proper footing. Then, with regard to charging a rate outside the municipality beyond what was charged inside, his lordship trusted all would approve of it. The community of Glasgow were the parties responsible to find the capital to take over, maintain, and uphold the gas-works, and they would have also to bear the assessment if such was required. It was, therefore, desirable in these circumstances to keep up a difference—but the difference should be moderate and not excessive—and, as fixed, it would only be about 5 per cent., or thereby. The Lord Provost concluded by moving the approval of the report.

Mr. DALLAS said he approved of the report, with the exception of the part where it was proposed to give £5000 to the corporation for their purposes. Until the price of gas was reduced to 3s. or 3s. 6d. per 1000 cubic feet, he held it would be unjust to the citizens to give such a sum to the corporation.

Mr. HUTCHISON said it was mentioned in the report that a substantial reduction was now to be made in the price of the gas, and his lordship had indicated that this reduction was to be made over a wider area. Whatever the wider area was, there were a certain number of consumers who would have to pay more for their gas. Those large consumers who got 10 per cent. and upwards of discount would be paying more now than they previously did. He alluded specially to one body with which he was connected—the Clyde Trust—which formerly paid at the rate of 3s. 10d. per 1000 feet, and would now pay at the rate of 3s. 11d. When the Act was got, it was got upon the understanding that there was such a large amount of gas consumed by the various bodies in connexion with the corporation, and that it would be for their benefit as well as others. Instead of this, the Clyde Trust would be paying more. That was rather unreasonable. There surely must be some mistake in the committee making such an arrangement.

The LORD PROVOST, in answer to Mr. Hutchison, said it was not possible to reduce the price of gas without losing money by it. The price must be regulated by the cost of the gas, and to have given these different discounts to the large consumers would have been giving the gas at a lower price than it cost the corporation. The Clyde Trust were just in the position of a host of others whose consumption was up to the rate that would entitle them to the large discount. The extent to which the gas would be dearer to them was very small indeed, for, in the case of £100, the increase was just ¾d.; and, from £20 to £100, to the extent of ½d. The reduction that had been made to consumers who paid 4s. 7d. as a net price would give a benefit of £16,916; and the reduction in price from 4s. 7d. to 4s. 4½d. to those beyond the municipality would give a benefit of £904, or a total of £17,820. Against that they would recover, by doing away with the discounts, from those who had hitherto had these large discounts, the sum of £8772. His lordship went on to explain why there ever came to be those large discounts. It arose from the competition of two companies, who were desirous to have as large a share of the trade as possible. In the circumstances in which these companies were placed, they would not, he might venture to say, closely consider whether it were a halfpenny more or a halfpenny less; but the corporation were bound to consider and ascertain the exact cost of the gas, and take care not to lose.

Bailie WATSON thought that the thanks of the council should be given to the Lord Provost and those other gentlemen who had taken such an amount of trouble in connexion with the gas bill.

Mr. MORRISON submitted the following amendment:—"That the recommendation of the Gas Committee to pay over £5000 to the corporation funds be not approved of, and that the balance of £5135 17s. 5d. be carried forward to the credit of next year's account." In doing so, he said he was not aware that there was any precedent for such a transfer of funds as was now proposed. The Water-Works Commissioners, as far as he was aware, had not so transferred their surplus profits, and if they had he was sure it would not have been in their power at this time to make the reduction to the ratepayers which they were happily able to do. Apart from this, he asked whether it was a prudent thing, in the first year of an undertaking of such magnitude, with a rental of nearly a quarter of a million per annum, to pass such a sum out of their hands at once, without any reservation beyond the mere sum allowed for depreciation in plant, which they knew for a certainty would take place, leaving unprovided for any possible accident during the year, which might itself absorb £5000. It appeared to him that no commercial man would be warranted in acting in this way, but that he could only prudently do so after years had passed, and the undertaking was fairly established. The disposal of this sum of £5000, let it be observed, was not the issue before the council; it was the much larger question whether the annual profits of the gas company should be applied, or a large portion of these profits at all events, to general corporation purposes. The Lord Provost had stated that the corporation were poor. If this were really the case, the financial statements must be wrongly put, for, according to last year's report, the corporation property reached a total value of about a quarter of a million, so that they did not require to borrow from a comparatively young process of manufacture. Then, taking it on the principle of revenue, he found from last year's report that the ordinary revenue of the corporation was £17,418 0s. 1d., and the ordinary expenditure was £14,722 2s. 2d., leaving a surplus of £2695 17s. 11d. Last year the extraordinary expenditure, arising from a series of exceptional causes, many of which could not be anticipated, and were not likely to recur, amounted to £6133 13s. 3d., leaving on the total transactions of the year a net deficiency of £1597 15s. 4d. He did not think, therefore, that the corporation funds were in such a bad state as the Lord Provost would have them believe. In the first place, they had not only a surplus revenue of something like £2695 17s. 11d., but they had upwards of £100,000 worth of their quarter of a million of assets not in a state to produce revenue, but which, in the hands of the Finance Committee, with very little trouble, could be made to produce revenue. There was upwards of £100,000 of the corporation funds invested in land in the Barony, Gorbals, and other populated parts of the city, surrounded by the land of other proprietors which was feued and being feued daily, whereas the corporation land only produced on this £100,000, so far as he had been able to see, something like £473 9s. 1d. Mr. Morrison went on to say that the reason why he asked the question about the application of the £150 mentioned in the tramways agreement was, that he might know whether that sum was to go to the corporation or to be handed over to the Police Board. The answer which was given decided him in his intention to move this amendment. If the £150 had been going into the funds of the Police Board, he might not have been so obstinate in opposing this appropriation of the £5000. The £150 per mile, supposing there were 20 miles of tramways, represented an additional revenue of £1500 a year going into the funds of the corporation; and if the council allowed this £5000 to be laid aside also, then it was one of two things—either it was a kind of encouragement to little municipal extravagances, or else it was adding to the corporation capital. He did not care in which of the two ways it was taken; he was quite prepared to oppose either. He did not think it was right that they should have too much money. Their revenue was increasing, and their land was increasing in value every day, and they were in a very happy condition, and did not need to rob the poor Gas Committee, and leave only £135 17s. 5d. to its credit. Then if this sum of £5000 was passed away to the general credit of the corporation, and if they increased the capital fund to that extent, it only gave posterity an advantage for which the present ratepayers were to pay. It was prudent to lay aside for posterity, but were they to sacrifice everything for this great posterity? His lordship had alluded to Manchester, but that was not a parallel case, for in Manchester there was no City Improvement Trust.

The TOWN-CLERK (Mr. Monro): There is.

Mr. MORRISON: There is not.

The TOWN-CLERK: Oh, yes; it is out of the gas.

Mr. MORRISON: Ah, that is a different thing altogether. There was, he continued, no direct special tax on the ratepayers of Manchester for carrying out city improvements. Now his lordship proposed to outvie Louis Napoleon, or Bismarck himself; he proposed to tax the citizens directly for city improvements, and to lay aside a surplus not only for the present day but for future generations as well. It appeared to him that if the ratepayers were liable to be assessed to the extent of 6d. per £1, it was fair and reasonable that they should insist upon the committee who had charge of that great undertaking putting it in such a position that the ratepayers could never by any possibility be called upon to pay a single penny. Mr. Morrison concluded by moving the amendment he had read.

Mr. COLLINS seconded the amendment. He believed that a limited capital and a modest income were sometimes good things as giving a stimulus to exertion in the way of improvement, which, with ample resources, might never be attempted. It was, he contended, totally wrong in principle to apply moneys raised for a certain purpose to one totally different, and he held that the interests of the ratepayers or gas consumers were not identical with those of the corporation. Under the proposals of the committee, the rate charged for gas was not to be reduced to the Police Board. He remembered that, when this subject was first discussed, one of the strongest arguments for the bill was that the rate would be reduced to the Police Board; and if this were done now he believed the police assessment might be lowered to the extent of 1d. in the pound. To apply this surplus of £5000 in the way proposed was therefore indirectly to tax the ratepayers to the extent of 1d. extra for police purposes. On the whole, he believed this was the thin end of the wedge, and he did not require to look far to see the wedge driven home. Mr. Collins went on to read a letter which he had just received, informing him that the Fifth Ward Committee, at a meeting held on this subject, unanimously disapproved of the proposed application of this sum of £5000.

Bailie W. MILLER said he believed it was decided, when the bill was obtained that the corporation might take over a portion of any balance that might arise for corporation purposes, and he thought it perfectly fair that they should do so now, after the reductions which had been made. With regard to the Police Board, he confessed that he had argued very strongly for a reduction being made in their case equivalent to that which had been conceded to small consumers, and he also believed, with Mr. Collins, that such a reduction would have enabled them to reduce the police-rate to the extent of 1d. in the pound. But while he had argued this course, he felt that the argument of the Gas Committee against doing this was a fair and just one. In all the circumstances, he was contented to wait another year, in the hope that then a reduction might be made in the case of the Police Board. Even with the reductions now made, and without taking into account the reasonable expectation that things would be much better next year than they had been during the past year, it was calculated that there would be a gross profit of about £53,000. With regard to what Mr. Morrison had said about the financial position of the corporation, he contended that it was in reality a poor corporation.

Mr. SIMPSON said that, as a business man, he objected to the £5000 being taken and handed over to the corporation. The money, in a sense, had been made by the gas consumer, and he ought to get the benefit of it.

Mr. TORRENS suggested that the portion of the report referring to the £5000 should be left over for future consideration. (Cries of "No, no," and "Vote.")

The council then divided, with the following result:—

For the Lord Provost's motion	19
For Mr. Morrison's amendment	21

The amendment was accordingly carried by a majority of 2.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page 657.*)

Mr. DAVID SCOTT, Gas-Works, Musselburgh, read the following paper:—

ON THE MANUFACTURE OF ILLUMINATING GAS FROM THE SECONDARY PRODUCTS IN THE PRODUCTION OF PARAFFIN OILS.

Paraffin is derived from the Latin words *parvum*, little, and *affinis*, akin. It consists of saturated hydrocarbons, and receives its name from its remarkable chemical indifference. Solid paraffin is a tasteless, inodorous, fatty substance, and resists the action of both acids and alkalies. It is insoluble in water, slightly so in alcohol, freely soluble in ether, and miscible in all proportions when melted with fixed or volatile oils. It occurs ready formed in American petroleum, and in other mineral oils of similar origin. It is obtained from wood tar, but its principal source is cannel coal and bituminous shale.

It is the temperature at which coal is carbonized in the retorts which determines the nature of the products. If the heat be low, condensable vapours alone will form; if it be high, the products will be in a great part or wholly gaseous. In the first case, the result will be paraffin oil; and, in the second, permanent gas. Our coals present the greatest diversity of composition in relation to the manner in which they break up into gas and other products, when modified by heat slowly or rapidly applied, and a large field is opened to the gas engineer, who takes as great an interest in the chemical changes as in the mechanical actions taking place in a gas-work. By a judicious selection of his materials, and a proper regulation of the temperature applied to his retorts, he will be able to produce results alike beneficial to his employers and the public.

The secondary or refuse products in the refining of paraffin oils consist chiefly of the hydrocarbon bases present in the crude oils, and are removed by alternately treating the oils with acids and alkalies in suitable apparatus. They are popularly known as acid and alkaline tars, and are looked upon as waste products, having no commercial value, and often taxing the ingenuity of refiners how to get rid of them in the easiest way, and at the least expense.

Mr. Wm. Young, engineer and manager of the Magdalen Bridge Chemical Works, near Musselburgh, has for some time turned his attention to this subject, and has hit upon a method of treating the tars so as to make them available for the manufacture of illuminating gas. There is every prospect, therefore, of their being soon taken out of the category of nuisances, and applied to beneficial uses. His method of treatment is shortly as follows:—The acid tar is first exposed to the action of steam in a suitable vessel, and with constant agitation, so as to present continually a fresh surface. By this means the greater portion of the acid is washed out, and by combining with the condensed steam is drawn off at the bottom of the vessel. The alkaline tar is then run in, and the whole well boiled, and washed with water, so as to remove all trace of free acid. The combined tars are now in a fit state for the manufacture of gas, and are of a thick sirupy nature, and of a black, inclining to brown, or sooty colour. If the purified tar be now distilled, the result will be a heavy green oil, and having a specific gravity of 9466 (water = 10,000). In both forms—namely, as purified tar and as heavy green oil—this substance is equally suitable for the manufacture of illuminating gas.

This purified tar or tar oil is a highly complex mixture of various compounds of carbon and hydrogen, and exists in the state of gas chiefly as a carburetted hydrogen; light carburetted hydrogen, being the most abundant, and olefiant gas, along with small proportions of other carbides of hydrogen, which possess similar properties, being the most valuable, as it is to them that the whole gas is indebted for its illuminating power. The tendency of destructive distillation is to simplify or produce compounds possessing more simplicity of composition than the original substance, and better capable of sustaining the high heat at which they form unaltered. The vapours generated in the centre of a mass of coals in the retorts may consist of the highest number of atoms of carbon and hydrogen; but as soon as they escape from the mass, and come in contact with the highly heated surface of the retorts, the augmented temperature has a tendency to lessen the complexity of the compound by dropping or reducing its amount of carbon or of hydrogen, and forming simpler and more stable compounds. The essential and characteristic feature in the manufacture of gas from this tar or tar oil is not the obtaining of new products, but for obtaining the same bodies that have hitherto been obtained from parrot coal by means of a cheaper material.

I will now give a statement of the different trials made with the tar, the results obtained, and cost of material used, together with the different methods adopted, so as to get beneficial results:—

Trial 1.—By mixing 1 ton of coal dross and 3 cwts. of tar—the dross yielding 8200 cubic feet of 12-candle gas—the following results were obtained:—

Gas from mixture of dross and tar	10,300 cubic feet.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	46 minutes.
Illuminating power of 5 cubic feet of the gas	17 candles.
Value of 1 cubic foot of the gas in sperm	408 grains.
Value of (10,300 cubic feet) gas from mixture in sperm	600 lbs.
Gas from 1 ton of the tar	14,000 cubic feet.
Illuminating power of 5 cubic feet of the gas	36·5 candles.

Trial 2.—We used the same dross, but a larger quantity of tar. Proportions—1 ton of dross and 4 cwts. of tar.

Gas from mixture	10,200 cubic feet.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	65 minutes.
Illuminating power of 5 cubic feet of the gas	32 candles.
Value of (10,200 cubic feet) gas from mixture in sperm	1,119 lbs.
Gas from 1 ton of the tar	10,000 cubic feet.
Value of the gas from tar in sperm	3,910 lbs.

N.B.—In this experiment we were working with inferior heats.

Trial 3.—We used Limerigg dross 1 ton, and 4 cwts. of tar.

Gas from mixture	11,800 cubic feet.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	50 min. 26 sec.
Illuminating power of 5 cubic feet of the gas	23 candles.
Durability of 1 cubic feet of the gas after standing 48 hours	50 minutes.

Cost of Material.

Experiment No. 1—
1 ton of dross = 4s. 8d.
3 cwts. of tar = 4 6
= 9s. 2d.
Cost per 1000 cubic feet of gas = 10·67d.

Experiment No. 2—
1 ton of dross = 4s. 8d.
4 cwts. of tar = 6 0
= 10s. 8d.
Cost per 1000 cubic feet of gas = 12·55d.

Experiment No. 3—
1 ton of dross = 6s. 2d.
4 cwts. of tar = 6 0
= 12s. 2d.
Cost per 1000 cubic feet of gas = 12·20d.

From the above experiments it will be seen that a good permanent gas can be obtained from this material at a very cheap cost, when mixed with a dross coal yielding a large volume of gas of poor quality. It will be found advantageous to use a dross inclined to cake of itself, as by this means an excellent fuel for the furnaces is secured. As the gas from the tar contains merely a trace of sulphur, its action on the purifiers is exceedingly easy.

As I have made no experiments on the tar oil, I am not prepared to speak on the subject. I have, however, been kindly furnished with a series of experiments by Mr. Cusiter, of Dalkeith, both on the tar oil and also on the tar for the manufacture of gas. I have much pleasure in embodying them in this paper, and shall now give his observations and results.

The tar oil had a specific gravity of 9466, taking water = 10·000. One gallon of the oil, therefore = 9·466 lbs., or 1 ton of the oil = 236·6 gallons.

I have made altogether five experiments on this oil, to determine the most economical method of treatment for the manufacture of gas. Clay retorts were used in all the experiments with the exception of the first, which was performed in an experimental iron retort, used in the laboratory for determining the relative values of coal and other products for gas.

EXPERIMENT No. 1.

Three pounds of oil were used for the experiment, and the gas was generated by introducing the oil through an iron syphon-pipe fastened to the lid, and reaching back nearly to the end of the retort.

Commercial Results.

Gas from 3 lbs. of oil	21·3 cubic feet.
Gas per ton of oil	15,904 ,,
Illuminating power of 5 cubic feet of the gas	38·5 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	72 minutes.
Durability of 1 cubic foot of the gas after standing in the gasholder for 40 hours	67 min. 54 sec.

EXPERIMENT No. 2.

The oil was delivered into the retorts by ¾-inch iron syphon-pipes through the retort-lids, the pipes projecting 4 feet into the retorts.

Commercial Results.

Gas per ton of oil	18,110 cubic feet.
Illuminating power of 5 cubic feet of the gas	23·55 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	50 min. 30 sec.

EXPERIMENT No. 3.

The oil was delivered into the retorts by ¾-inch iron syphon-pipes, through the cone covers on the back end of the retorts.

Commercial Results.

Gas per ton of oil	28,300 cubic feet.
Illuminating power of 5 cubic feet of the gas	12 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	37 minutes.

EXPERIMENT No. 4.

This experiment was performed on a combination or mixture of pulverized splint coal and oil. Quantities used—1 ton of splint coal, and 30 gallons, or 284 lbs., of oil; number of retorts, 6 clay; heat, our ordinary in gas manufacture; weight of charge per retort, 186¾ lbs. of pulverized coal and 23¾ lbs. of oil.

A.—*Analysis of Pulverized Splint Coal.*

Gas per ton of coal	10,000 cubic feet.
Illuminating power of 5 cubic feet of the gas	14 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	41 min. 10 sec.

B.—*Analysis of One Ton of Pulverized Splint Coal, and 30 Gallons, or 284 lbs., of Oil.*

Yield of gas from mixture	12,500 cubic feet.
Illuminating power of 5 cubic feet of the gas	25·89 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	54 min. 30 sec.
Gas per ton of oil	19,718 cubic feet.

EXPERIMENT No. 5.

One ton of pulverized splint coal and 42 gallons of oil were used in this experiment. The coal was charged in the ordinary way, and the oil delivered into the back ends of the retorts by ¾-inch iron syphon-pipes.

Commercial Results.

Gas from 1 ton of coal and 42 gallons of oil	13,140 cubic feet.
Illuminating power of 5 cubic feet of the gas	23·59 candles.
Durability of 1 cubic foot by jet of 5-inch flame	51 min. 29 sec.
Gas per ton of oil	17,690 cubic feet.

When this oil is used alone for the manufacture of gas, iron retorts are preferable to clay, being less porous, and better conductors of heat. With iron retorts and moderate heats, a large volume of gas of very superior illuminating power can be obtained by running the oil in a continuous stream into the retorts. This temperature suffices to convert the oil into permanent gas, but is not sufficiently high to decarbonize the gas to any great extent. With clay retorts, the gas, having to pass over a large and highly heated surface, becomes decarbonized, its illuminating power being greatly reduced, and leaving a large deposit of carbon in the retorts and stand-pipes.

The gases from an intimate mixture of coal and oil, charged in the ordinary way (Experiment 4), by being brought in contact at the instant of liberation, or in the nascent state, a new combination takes place, yielding more and better gas from a given amount of the material.

From the results of my experiments on this oil, I have come to the conclusion that for gas-works where clay retorts are wrought at high heats, the best results, in a commercial point of view, will be obtained when the gases from the coal and oil are brought in contact at the instant of decomposition, and before they have combined with caloric, or have assumed the gaseous state. This can be accomplished by running the oil into the retorts during the distillation of the charge of coal, or, perhaps better still, by intimately mixing the coal and oil before charging.

Experiment on a Mixture of the Purified Tar and Pulverized Splint Coal.

In the distillation of the tar it was mixed with pulverized splint or dross coal in the proportion of 336 lbs. of the tar to 1 ton of the coal. The experiments were performed in clay retorts, in our ordinary process of gas-making.

By the method adopted in the purification of the tar all free sulphuric acid present is completely neutralized, and the sulphur compounds removed, so that the gas is easy of purification.

The following commercial results show that this tar, when mixed in the foregoing proportions with pulverized splint or dross coal, yields a large volume of gas of good average commercial value, and may be advantageously used as a substitute for cannel coal for the manufacture of illuminating gas:—

Gas per ton of dross coal and 336 lbs. of tar	114·93 cubic feet.
Illuminating power of 5 cubic feet of the gas	25·91 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	54 min. 52 sec.

I have thus endeavoured, however imperfectly, to lay before you the results of my experiments on the secondary products in the manufacture of paraffin oil, applied as a substitute for cannel coal in the production of illuminating gas. My object in bringing it under your notice is to induce others more competent than I am to examine into and form their own conclusions on this matter. This can only be satisfactorily accomplished by a series of experiments on the

large scale, or in the retort-house. With the gas managers of this association I therefore leave it, either for approval or condemnation.

The following discussion followed the reading of this paper:—

Mr. HISLOP (Paisley) considered this was a subject of very considerable interest to them; but it occurred to him that it would have been of much greater importance had Mr. Scott shown them by per centages the results accruing from the different mixtures. By this means they would have seen the advantages of the different modes. For instance, by mixing common coal tar with coal he got results something like 42 per cent. of an increase; whereas with paraffin oil he got about 50 per cent. He merely suggested this while he agreed that the paper was a valuable one, and would propose that a vote of thanks should be awarded to Mr. Scott for his paper.

Mr. MACRAE (Dundee) said that although Mr. Hislop, with his extensive experience, might wish to get things put in per centages, yet he (Mr. Macrae) thought that the majority would prefer the figures as given by Mr. Scott; it was intelligible to the whole of them. He believed that Mr. Scott was quite right in what he had stated.

Dr. STEVENSON MACADAM then laid the following report on the table:—

Analysis and Report on the Foregoing, by Stevenson Macadam, Ph.D., F.R.S.E., F.C.S.

I have made a series of experimental observations upon the value of paraffin oil waste products, placed in my hands by Messrs. W. Taylor and Co., with special reference to the employment of such in the manufacture of illuminating gas. The oil products consist of—

1. Tar oil, a black sluggish liquid of specific gravity 968; and
2. Distilled oil, a green fluid oil of specific gravity 934.

Two sets of experiments were carried out with these oils—the first being the saturation of small coal with the oils, and the distillation of the mixture in gas-retorts in the ordinary way followed in gas-works; and the second being the decomposition of the oils in gas-retorts filled with red-hot coke, and the consequent distillation of illuminating gas.

A. *Saturation of Small Coal with the Oils, and the Distillation of the Gas.*—The coal employed in these trials was the Virtue Well household coal, which affords an excellent coke when carbonized. The coal being broken up, was treated with the respective oils in the proportion of 30 gallons of the oil to 1 ton of the coal, and the mixture was thereafter subjected to distillation. The following results were obtained:—First, from the coal taken by itself; secondly, from the coal treated with the distilled oil; and, thirdly, from the coal mingled with the tar oil.

Distillation of Gas from Coal saturated with Paraffin Oil Waste Products.

	Volume of Gas from 1 Ton of the Coal, in Cub. Feet.	Condensation of the Gas by		Durability of the Gas, 1 Cub. Foot.		Photogenic Power of the Gas in Standard Sperm Candles.
		Potash = Carbonic Acid.	Bromine = Heavy Hydrocarbons.	4-inch Flame.	5-inch Flame.	
				Min.	Min.	
1. Virtue Well coal, taken by itself	10,938	0·2	6·0	43	54	13·57
2. Virtue Well coal, treated with 30 gallons of distilled oil to 1 ton of coal	11,013	0·1	9·2	48	60	20·27
3. Virtue Well coal, mingled with 30 gallons of tar oil to 1 ton of coal	10,662	0·1	9·0	45	56	17·60

In contrasting the above results obtained by distilling the Virtue Well coal alone, and when saturated with the distilled and tar oils, it will be observed that, whilst the volume of the gas remains practically the same, the per centage of hydrocarbons rises from 6 to 9·2 per cent. in the case of the distilled oil, and to 9 per cent. with the tar oil; whilst the photogenic power of 5 cubic feet of the gas consumed during the hour, reckoned in standard sperm candles, increases from 13·57 to 20·27, or 6¾ candles, when the distilled oil is employed, and from 13·57 to 17·60, or a difference of 4 candles, when the tar oil is used. The advantages gained by the saturation of small coal with these paraffin oil products, and subsequent distillation, are therefore marked and commercially encouraging; and the only difficulty I apprehend in the practical carrying out of the process is the possible separation of the oil gas in the gasometers and main-pipes.

B. *Decomposition of the Oils in Gas-Retorts over Red-Hot Coke.*—In these experiments the oils were run on to the surface of the ignited coke, when decomposition instantly occurred, and illuminating gas was obtained. The following table gives the detailed results:—

Distillation of Gas from Distilled and Tar Oils over Red-Hot Coke.

	Volume of Gas from 1 Ton of the Oil, in Cub. Feet.	Condensation of the Gas by		Durability of the Gas, 1 Cub. Foot.		Photogenic Power of the Gas in Standard Sperm Candles.
		Potash = Carbonic Acid.	Bromine = Heavy Hydrocarbons.	4-inch Flame.	5-inch Flame.	
Distilled or green oil (specific gravity 934)	20,464	0·1	12·0	53	65·5	22·55
Tar oil (specific gravity 968)	19,993	0·1	12·0	51	63·0	20·90

It will thus be observed that the distilled oil is capable of yielding from 1 ton of the oil fully 20,400 cubic feet of gas of 22·55-candle power; whilst the tar oil affords, under the same treatment, 20,000 (19,993) cubic feet of gas of 21 (20·90) candle power. These results are highly satisfactory so far as the production of a large volume of good coal gas is concerned; and the only point which I consider requires further elucidation is the question of the permanency of the quality of the gas, especially that obtained from the tar oil.

Dr. MACADAM said that in regard to Mr. Hislop's suggestion, he might state that the getting up of per centages occupied a great deal of time, and materially added to the trouble in preparing a paper for a meeting. Mr. Scott had done his part exceedingly well. In a second paper, on the same subject, they would no doubt have the per centages presented to them. He had made the trials in concert to some extent with Mr. Scott, and there could be no doubt as to the increase of the illuminating power of gas. The report which he had submitted contained some experiments made by himself. These experiments were conducted with the view of determining how far coal saturated with these oils could have the gas, naturally heated by that coal, increased in illuminating power. The coal known as the Virtue Well coal yielded 11,038 cubic feet of gas. The coal they worked with, and which they intended afterwards to saturate, yielded 11,000 cubic feet of gas, and this had an illuminating power of 13½ candles. They employed that coal and reduced it to small pieces, the quantities being 30 gallons of distilled oil to one ton of coal. The oil having a density of ·934 was less than 300 lbs. One point they wished to guard against was the running up of the power of gas. They managed so that they should not get more than 11,000, which might be regarded as the natural quantity yielded by the coal. This gas had an illuminating power of 20¼ candles, and they had therefore an increase of 6¾ candles in the illuminating power. The process with distilled oils was a very expensive one, as the manufacturer was at the trouble of distilling the tar. With tar oil they had employed in making the experiments a proportion of 30 gallons to the ton. That had a specific gravity of ·968. They obtained 10,650 cubic feet of gas, the illuminating power being equal to 17¼ candles. All the experiments were very satisfactory so far as concerned the production of increased illuminating power of gas. The only difficulty he had with the employment of these oils in the production of illuminating gas was in regard to the quality of the gas. Further experiments would require to be made to determine whether the gas could be depended on to keep up this quality. That they could raise the illuminating power, and reduce the method to practical purposes, he had not the slightest doubt.

Mr. CUSITER said it appeared to him, from the slight examination he had been able to make of Dr. Macadam's report, that it differed not only from his (Mr. Cusiter's) and Mr. Scott's reports, but from itself.

Dr. MACADAM said that it was stated that the illuminating power of gas did not increase after standing for some time. He did not wish to give the new results of his experiments, as he wanted and still wished to leave the matter an open question. In one of his experiments the illuminating power had decreased, after the gas had stood in the gasometer over night, from 20·90 per cent. to 13·2 per cent. These figures did not settle the question, as a great deal depended on the manner of manipulating while experimenting. It was quite possible he might come forward next year, and tell them that there was no decrease in the illuminating power, as by that time some plan might be discovered for making the gas more permanent.

The following is Mr. Cusiter's report, which was submitted to the meeting:—

Analyses and Report on a Sample of Oil from the Secondary Products in the Manufacture of Paraffin Oils, applied as a Substitute for Cannel Coal in the Production of Gas.

Received from Messrs. Taylor and Co., soap and candle manufacturers, Leith, from their paraffin works, Magdalen Bridge, Musselburgh, a sample, consisting of four casks, of this oil for examination and analyses.

The oil had a specific gravity of 9466, taking water equal to 10,000. One gallon of the oil, therefore = 9·466 lbs., or 1 ton of the oil = 236·6 gallons.

I made altogether five experiments on this oil to determine the most economical method of treatment for the manufacture of gas. Clay retorts were used in all the experiments with the exception of the first, which was performed in an experimental iron retort, used in the laboratory for determining the relative values of coal and other products for gas.

EXPERIMENT No. 1.

Three pounds of oil were used for the experiment, and the gas was generated by introducing the oil through an iron syphon-pipe fastened to the lid, and reaching back nearly to the end of the retort.

Commercial Results.

Gas from 3 lbs. of oil	21·3 cubic feet.
Gas per ton of oil	15,904 "
Illuminating power of 5 cubic feet of the gas	38·5 candles.
Value of 1 cubic foot of the gas in sperm	924 grains.
Value of gas per ton of oil in sperm	2099·328 lbs.
Hydrocarbons absorbed by bromine	19·2 per cent.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	72 minutes.
Durability of 1 cubic foot of the gas after standing in the gasholder for 40 hours	67 min. 54 sec.

EXPERIMENT No. 2.

The oil was delivered into the retorts by ¾-inch iron syphon-pipes through the retort-lids, the pipes projecting 4 feet into the retorts.

Commercial Results.

Gas per ton of oil	18,110 cubic feet.
Illuminating power of 5 cubic feet of the gas	23·55 candles.
Value of 1 cubic foot of the gas in sperm	565·2 grains.
Value of gas per ton of oil in sperm	1462·253 lbs.
Hydrocarbons absorbed by bromine	9 per cent.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	50 min. 30 sec.

EXPERIMENT No. 3.

The oil was delivered into the retorts by ¾-inch iron syphon-pipes, through the cone covers on the back end of the retorts.

Commercial Results.

Gas per ton of oil	28,300 cubic feet.
Illuminating power of 5 cubic feet of the gas	12 candles.
Value of 1 cubic foot of the gas in sperm	288 grains.
Value of gas per ton of oil in sperm	1164·342 lbs.
Hydrocarbons absorbed by bromine	3 per cent.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	37 minutes.

EXPERIMENT No. 4.

This experiment was performed on a combination or mixture of pulverized splint coal and oil. Quantities used—1 ton of splint coal, and 30 gallons, or 284 lbs., of oil; number of retorts, 6 clay; heat, our ordinary in gas manufacture; weight of charge per retort, 186¾ lbs. of pulverized coal, and 23¾ lbs. of oil.

Analysis of Pulverized Splint Coal.

Gas per ton of coal	10,000 cubic feet.
Illuminating power of 5 cubic feet of the gas	14 candles.
Value of 1 cubic foot of the gas in sperm	336 grains.
Value of gas per ton of coal in sperm	480 lbs.
Hydrocarbons absorbed by bromine	5 per cent.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	41 min. 10 sec.

Analysis of One Ton of Pulverized Splint Coal, and 30 Gallons, or 284 lbs., of Oil.

Yield of gas from mixture	12,500 cubic feet.
Illuminating power of 5 cubic feet of the gas	25·89 candles.
Value of 1 cubic foot of the gas in sperm	621·36 grains.
Value of the gas from mixture in sperm	1109·571 lbs.
Hydrocarbons absorbed by bromine	9·2 per cent.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	54 min. 30 sec.
Gas per ton of oil	19,718 cubic feet.

EXPERIMENT No. 5.

One ton of coal and 42 gallons of oil were used in this experiment. The coal was charged in the ordinary way, and the oil delivered into the back ends of the retorts by ¾-inch syphon-pipes.

Gas from 1 ton of splint coal and 42 gallons of oil	13,140 cubic feet.
Illuminating power of 5 cubic feet of the gas	23·59 candles.
Value of 1 cubic foot of the gas in sperm	566·16 grains.
Value of gas from 1 ton of coal and 42 gallons of oil in sperm	1062·76 lbs.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	51 min. 29 sec.
Gas per ton of oil	17,690 cubic feet.

Remarks.—The foregoing analyses show this oil to be a very superior gas-producing material, both for rapidity and volume of production, and for photogenic or illuminating power.

When this oil is used alone for the manufacture of gas, iron retorts are preferable to clay, being less porous, and better conductors of heat. With iron retorts and moderate heats, a large volume of gas of very superior illuminating power can be obtained by running the oil in a continuous stream into the retorts. This temperature suffices to convert the oil into permanent gas, but is not sufficiently high to decarbonize the gas to any great extent. With clay retorts, the gas, having to pass over a large and highly heated surface, becomes decarbonized, its illuminating power being greatly reduced, and leaving a large deposit of carbon in the retorts and stand-pipes.

The gases from an intimate mixture of coal and oil, charged in the ordinary way (Experiment 4), by being brought in contact at the instant of liberation, or in the nascent state, a new combination takes places, yielding more and better gas from a given amount of the material.

From the results of my experiments on this oil, I have come to the conclusion that for gas-works where clay retorts are wrought at high heats, the best results, in a commercial point of view, will be obtained when the gases from the coal and oil are brought in contact at the instant of decomposition, and before they have combined with caloric, or have assumed the gaseous state. This can be accomplished by running the oil into the retorts during the distillation of the charge of coal, or, perhaps better still, by intimately mixing the coal and oil before charging.

This oil, when used alone or with coal, gives a permanent gas, differing in this respect from gas produced from a mixture of coal and shale oils.

The oil is almost entirely free from sulphur, so that its purification is exceedingly easy.

Purified Tar from the Secondary Products in the Manufacture of Paraffin Oils.

In accordance with the request of Mr. William Young, engineer and manager of Messrs. William Taylor and Co.'s chemical works at Magdalen Bridge, near Musselburgh, I have made a careful commercial analysis of the above-named tar for gas manufacture. In the distillation of the tar, it was mixed with pulverized splint or dross coal, in the proportion of 336 lbs. of the tar to 1 ton of the coal. The experiments were performed in clay retorts in our ordinary process of gas-making.

By the method adopted in the purification of the tar, all free sulphuric acid present is completely neutralized, and the sulphur compounds removed, so that the gas is easy of purification.

The following commercial results show that this tar, when mixed in the foregoing proportion with pulverized splint or dross coal, yields a large volume of gas of good average commercial value, and may be advantageously used as a substitute for cannel coal for the manufacture of illuminating gas.

Commercial Results.

Gas per ton of dross coal and 336 lbs. of tar . . .	11,493 cubic feet.
Illuminating power of 5 cubic feet of the gas . .	25·91 candles.
Durability of 1 cubic foot of the gas by jet of 5-inch flame	54 min. 52 sec.
Condensation by potash (carbonic acid)	None.
Hydrocarbons absorbed by bromine	9·4 per cent.
Gas from 1 ton of purified tar	9,953 cubic feet.

THE STANDARD FLAME.

Mr. Reid (Leith) brought forward the subject of the standard flame. He said it was apt to create some confusion that one party should use in experimenting the 4-inch standard and another the 5-inch standard. He thought it would be of great importance if the meeting would express an opinion as to whether the 4-inch or 5-inch standard should be uniformly used.

Mr. Macrae thought in all analyses of coal, where the durability was given, the 4-inch standard should be used.

Mr. Robb (Haddington) said it was many years since he had come to the opinion that the 4-inch standard was the only reliable one.

During the discussion that followed, the majority of the members expressed themselves in favour of the 4-inch flame.

At the request of the Chairman,

Mr. Buist (Halifax, America) addressed the meeting. He related his experience as a gas manager, and the difficulties they had to contend against in the manufacture of gas in America. When he went to America he was surprised at the low illuminating power at which they supplied the gas there. They got it as high as 18-candle power, but not beyond that. They got it as low as 13 from the common coal, without any mixture whatever. The price charged was 3 dols., or 12s. sterling. The reason of this was the extra expense to which they were put in supplying gas. The pipes had to be laid at least 6 feet below the ground to keep them free from the action of the frost. From February to May of last year they lost 25 per cent. from this cause. The process of manufacture was nearly the same as in this country, and the material used was a substance called Albertite coal. Properly speaking, it was not a coal, but a mineral pitch, as it could be dissolved in its own tar.

PRIZE ESSAYISTS.

The Secretary intimated that the prize essayists for this year were Mr. P. Innes, gas manager, Forfar, and Mr. A. Macpherson, gas manager, Kirkcaldy, Mr. Innes having been awarded the first prize of £10 10s. for his essay on the best mode of carbonizing coal, and Mr. Macpherson the first prize of £6 for his essay on the best mode of constructing and setting a bench of retorts.

The Secretary likewise intimated that the following gentlemen had each placed the sum of £5 at the disposal of the committee, to be awarded by them as prizes for the best papers on subjects in connexion with gas manufacture at the next annual meeting—viz.,

John Reid, Esq., Edinburgh and Leith Gas-Works.
J. K. Watson, Esq., Edinburgh Gas-Works.
A. Donaldson, Esq., of W. and B. Cowan, meter makers, Edinburgh.

Mr. Macrae said these competitions would be beneficial or otherwise, according as the thing was worked out. Without the slightest reflection upon the successful competitors of this year, he suggested that in future it should be made a condition that the prize-winners should appear at the annual meeting, so that they might be there to answer questions which might be put to them bearing on the views stated in the essays.

The Secretary stated that both the prize-winners would have been present at the meeting—although that had not been made a condition—had it not been for other engagements which utterly prevented them from attending.

Dr. Stevenson Macadam then delivered a lecture on "The Scientific Principles Regulating the Economic Distillation of Gas from Coal," a report of which will appear in our next.

A cordial vote of thanks was passed to Dr. Macadam for his lecture.

On the motion of Dr. Macadam, a vote of thanks was passed to Mr. Whimster for presiding.

This concluded the proceedings, and the meeting then separated.

The members, with their friends, afterwards met and dined together in the Café Royal Hotel. Mr. Thomas Whimster occupied the chair, and Mr. Hugh Bartholomew discharged the duties of croupier.

Dr. Frankland's Analysis of the Metropolitan Waters in August, 1870.—"Royal College of Chemistry, Aug. 27, 1870.—Sir, I have the honour to submit to you in the following table the results of the chemical examination of the waters supplied to the metropolis during the month of August. For the purpose of comparison, I append also the results yielded by the waters supplied to Birmingham, Manchester, Tunbridge Wells, Paisley, Hamilton, Airdrie, Greenock, and Glasgow, and by Thames water taken at Battersea Bridge at low and high water on the 1st of March. All the metropolitan waters were clear and transparent when drawn from the mains, except that supplied by the East London Company, which contained suspended particles, amongst which living organisms were found. The water supplied by the Kent Company from chalk wells contained the smallest proportion of organic elements; the New River Company's water stands next in this respect, and then that of the East London Company. The rest of the waters are drawn from the Thames, and of these that supplied by the Chelsea Company contained the smallest proportion of organic elements. The water abstracted from the Thames, below its junction with the Mole, by the Chelsea and Lambeth Companies, exhibited nearly twice as much previous sewage or animal contamination as that abstracted by the other companies above the junction. Owing chiefly to long storeage in reservoirs, the evidence of previous sewage contamination had entirely disappeared from the East London Company's water. The results of Dr. Hill's analysis of the water supplied to Birmingham, on the 3rd inst., show that it was highly charged with nitrogenous organic matter, and, as the water was also turbid and bright green with minute vegetation, it was quite unfit for domestic consumption. It is satisfactory to know that the Birmingham Water Company has just obtained powers from Parliament to bring in a purer and more abundant supply; in the meantime every exertion ought to be used to render the quality of the present supply less objectionable, by the removal of suspended impurities by sand filtration. The proportion of chlorine, often indicative of excremental pollution, has increased from 1·41 part in 100,000, on the 10th of May last, to 7·44 parts in 100,000, on the 3rd inst. The water supply of Tunbridge Wells is remarkable for its extraordinary purity as regards organic matter. It is of excellent quality and very soft, and, being derived from deep-seated springs, the evidence of previous animal contamination implies no appreciable risk, owing to the excessive filtration through rock which the water has undergone. Glasgow is fortunate in its abundant and constant supply of the very pure water of Loch Katrine, amounting to about 56 gallons per day per head, inclusive of that consumed for trade purposes. The Gorbals water, supplied to the southern portion of the same town, is also of good quality, and free from all suspicion of excremental pollution. It contains, however, more peaty organic matter than the lake water. Paisley, Hamilton, Airdrie, and Greenock are also supplied with good and wholesome water, exhibiting no evidence of previous animal pollution. These waters are, however, somewhat more peaty than is desirable.

Companies.	Date and Place of Collection.	Temperature in Centigrade Degrees.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Previous Sewage or Animal Contam. (Estimated).	Chlorine.	Total Hardness.
Thames.											
Chelsea.....	Aug. 12—Cadogan Pier, Sloane Street.	19·4	23·80	·118	·024	·000	·110	·134	780	1·55	18·24
	Aug. 11—Cadogan Pier, Horse Guards.										
West Middlesex.....	Aug. 11—Cadogan Pier, Portland Road.	20·5	23·76	·134	·029	·000	·087	·116	550	1·55	18·24
Southwark & Vauxhall..	Aug. 11—Cadogan Pier, St. George's Ch.	20·4	21·96	·121	·031	·000	·077	·108	450	1·58	17·30
Grand Junction.....	Aug. 11—Cadogan Pier, Woodstock St..	19·4	23·82	·133	·025	·000	·078	·103	469	1·57	18·08
Lambeth....	Aug. 11—Cadogan Pier, Lambeth Road.	19·4	25·98	·149	·028	·000	·118	·146	860	1·62	18·84
Other Sources											
New River...	Aug. 11—Cadogan Pier, Totnhm. Ct. Rd.	20·1	24·00	·056	·021	·000	·146	·167	1140	1·52	18·60
East London.	Aug. 12—Slater's, Old Ford Road.	21·7	21·34	·100	·027	·000	·027	·054	0	1·65	15·50
Kent.....	Aug. 12—Deptford Bdge. Police Sta.	15·3	39·10	·027	·019	·000	·482	·501	4503	2·38	27·22
Thames water, filtered..	Mar. 1, 1870—Battersea Br., mid-str., at low wat.	..	30·64	·451	·060	·024	·493	·573	4810	1·75	25·85
	At high water	..	32·20	·476	·048	·075	·364	·469	3940	2·05	25·02
Birmingham*	Aug. 3, 1870—Bir. Wr. Sup.	..	64·80	·573	·094	·003	·133	·229	1030	7·44	26·57
Manchester..	Jan. 29, 1870—Man. Wr. Sup.	..	5·74	·070	·007	·001	·000	·008	0	·80	2·48
Tunbridge W.	July 7, 1870—Water Supply from Pembury.	15·5	12·26	·002	·004	·000	·496	·500	4640	2·83	3·33
Paisley Wr. Supply..	July 21, 1870—Rowbank Res	16·4	11·68	·521	·068	·002	·000	·070	0	1·20	5·94
	Stanley Reser		9·14	·262	·034	·002	·000	·036	0	1·12	4·16
Hamilton....	July 28, 1870—Hamil. W. Sup.	17·8	11·76	·474	·052	·004	·000	·055	0	1·40	6·33
Airdrie.....	July 29, 1870—Airdrie W. Sup.	17·2	23·98	·381	·047	·002	·014	·063	0	1·38	9·81
Greenock....	July 26, 1870—Greenock W. S.	..	5·42	·501	·037	·002	·000	·039	0	1·00	1·91
Glasgow Wr. Sup.	Aug. 3, 1870—Loch Katrine	16·7	2·40	·185	·022	·001	·000	·023	0	·85	·88
	Gorbals	17·8	8·80	·339	·049	·002	·018	·069	0	1·11	4·41

* Analyzed by Dr. Alfred Hill, of Queen's College, Birmingham.

"The Registrar-General, &c." "E. Frankland.

The Corporation of Leeds and the Gas Companies.—The formal completion of the purchase of the gas-works in Leeds was accomplished by the corporation on Thursday, the 1st inst. Henceforth, therefore, the supply of gas to all parts of the borough is vested in the Town Council. The transfer document in connexion with the new company is as follows:—"In pursuance of the Leeds Corporation Gas Act, 1870, and in consideration of the sum of £330,334 16s., being the purchase-money for the undertaking of the Leeds New Gas Company, as ascertained, pursuant to the said Act, upon the execution of these presents to the said Leeds New Gas Company, paid by the mayor, aldermen, and burgesses of the borough of Leeds, the said company hereby make to the said mayor, aldermen, and burgesses, who hereby accept a transfer of all the undertaking, estates, property, and effects of that company, subject to deben-

ture stock, amounting to £59,285, charged on the said undertaking, and to all other charges, encumbrances, and liabilities now affecting that company, or any of the property thereof. As witness the respective common seals of the said company and the said mayor, aldermen, and burgesses, this 1st day of September, 1870." The affixing of the company's seal is attested by Mr. H. Snowdon, solicitor to the company; and that of the corporation by Mr. C. A. Curwood, town-clerk. The receipt is endorsed on the deed, and is signed by Mr. J. O. March, Mr. John Land, and Mr. Thomas Wood, and attested by Mr. Snowdon. In the transfer pertaining to the Leeds Gaslight Company, the wording is similar, but the sums are, of course, different. The purchase-money is £366,108 15s. 7d., and the transfer is "subject to various mortgages, amounting in the aggregate to £42,500, and to debenture stock amounting to the capital sum of £15,000, respectively charged on the said undertaking, and to all other liabilities now affecting that company." The seal of the company was affixed in the presence of Mr. T. T. Dibb and Mr. Jas. Lupton, secretary; and that of the corporation in presence of the town-clerk. To the receipt on the back, the names of Mr. Henry Oxley, Mr. Wm. Ingham, and Mr. Wm. Wray appear, and Mr. T. T. Dibb attests.—*Leeds Mercury.*

THE LATE MR. JAMES SHARP.—The town of Southampton has lost one of its most highly respected and useful citizens, and the cause of science a truly devoted disciple, by the death, on Sunday morning, the 4th inst., at the ripe old age of eighty, of Mr. James Sharp, many years manager of the Southampton Gas-Works. More than a fourth of his valuable life was spent in our midst, and for many a year to come his memory will be cherished as a household treasure by large numbers of the inhabitants, not only of Southampton, the town of his adoption, but of Northampton, the town of his birth, and other places in which from time to time he zealously laboured for the education and instruction of his fellow-creatures. Liberally endowed with talents of a varied character, and blessed with an active and energetic temperament, he was always ready to aid any good work calculated to improve and benefit the public. His services in this respect will not soon be forgotten in Southampton, where the Polytechnic Institution, in the earlier days of its history, and other similar organizations for the dissemination of literary and scientific knowledge, have been largely benefited by the exertions of the worthy man whose death we now mourn over. The first lecture delivered by Mr. Sharp in this town was in the year 1837, on "Cooking by Gas," and he subsequently gave between 40 and 50 lectures at different times, on subjects of a most useful character—such as optics, natural history, gas cooking, pneumatics, &c., &c., and it is here worthy of remark, as illustrative of his personal disinterestedness, that his services were invariably given gratuitously. Passed the age of 80, and living in peaceful retirement from the cares of business, the venerable gentleman, in the full possession of his mental faculties, was present at the annual meeting of members of the Polytechnic Institution so lately as the 10th of last month, and took part in the proceedings, much to the gratification of those who for longer or shorter periods were associated with him in that useful society. Mr. Sharp was born at Northampton in 1790, and a great taste for mechanics showing itself even in his early school-days, he was apprenticed for the old orthodox term of seven years to Mr. George Barnes, a watch and clock manufacturer in that town. Many of our readers whose knowledge of Mr. Sharp may be confined to his career in Southampton have little idea of the various departments of science in which he was a proficient, and we therefore reproduce from the *Expositor* for Feb. 22, 1851, the subjoined extract from an interesting paper on his earlier history:—

When about 25 years of age he set up in business for himself as a general machinist but launched out into a much wider field than came strictly within range of his trade. He studied optics, and became a maker of optical instruments; taught himself engraving, practised the art in all its branches, and had one articled pupil whom he taught, and who has now a high reputation as a copper-plate engraver. People from all the counties round used to come to him with half-invented contrivances to be finished, complicated mechanisms to be made and mended, and, did they but say that some other machinist or optician had declared the thing impossible, Sharp would set at it forthwith, and work day and night until, cost him what it might of toil and trouble, it was done. Such work, of course, was never fitly paid for, so he enjoyed a high reputation and a rather low purse.

The article from which these few lines are quoted also notices the invention and manufacture by Mr. Sharp of several delicate surgical instruments and contrivances for the relief of suffering, "amongst the best of which was a bed, which was afterwards constantly used at the Northampton County Infirmary, provided with steel supports for the various cases of diseased spine, and which the patients, though kept in a fixed position, could readily raise or lower to any angle or incline they wished." In 1820 his attention was turned to the question of gas lighting, and in 1822, on the formation of a company to light the town of Northampton with gas, he was appointed fitter and assistant manager, remaining in their employ for several years, and still engaged in the production of other mechanical appliances. From this time gas engineering became the great object of his life, and gas-illuminated clocks, gas-cooking apparatus, and other ingenious applications of the subtle vapour, were introduced by him in the metropolis and numerous provincial towns, and which will render the name of James Sharp a memorable one in the long rolls of scientific history. In 1839 he became manager of the gas-works in our neighbouring city of Winchester, where he gained a high reputation, converting a losing into a profitable concern, and after eight years service in that city he removed in 1847 to Southampton, to discharge the responsible duties of a like position here. How Mr. Sharp performed those duties not a word need be said by us now. Is it not written in the records of the company which he served so faithfully and so well, and in the memories of all who were associated with him, either in public or in private? For twenty years he was engaged, night and day, in a devoted attention to his office as manager and engineer of the Southampton Gas-Works, and when, in 1868, advancing age induced him to relinquish his duties, the company showed their appreciation of his long and valuable services in their employ by retiring him upon a pension of £200 per annum. On the 6th of August in that year, a large number of Mr. Sharp's friends entertained him at a complimentary dinner at the Royal George Hotel, the then mayor (Mr. Alderman Stebbing) and Mr. Alderman Perkins respectively officiating as chairman and vice-chairman. Surrounded on that occasion by a host of his personal friends and admirers, the venerated guest of the evening, in responding to the toast of his health, gave an interesting sketch of his life and labours in Southampton, in the course of which he mentioned, as an illustration of the increase which had taken place in the gas consumption of the town during his twenty years of office, that the number of retorts at the works when he entered upon his duties was 30, since multiplied to 380. Beloved and respected by all who knew him, Mr. Sharp has, since his retirement, resided with his only surviving daughter and her husband, Mr. George Grant, at Spohr Villa, in the Avenue, where on Sunday morning he peacefully passed away to his eternal rest. The deceased gentleman had recently paid his annual visit to Northampton and London, from whence he returned on the Tuesday preceding his death, suffering apparently from a cold in the head, and medical attendance was called in on Thursday, but nothing serious was then apprehended. He became worse, however, on the following day, and, as we have already stated, his long and useful life terminated in death on Sunday. And so has passed away from among us a man to whom may be strictly applied the words of the poet:

He stood in his integrity, just and firm of purpose,
Aiding many, fearing none, a spectacle to angels and to men;
Yea, when the shatter'd globe shall rock in the throes of dissolution,
Still will he stand in his integrity, sublime—an honest man.

—*Hampshire Independent.*

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

2344.—FREDERICK GRAY, of Birmingham, in the co. of Warwick, manufacturer, for "*Improvements in gas-lamps and other lamps.*" Aug. 26, 1870.

2350.—THOMAS LACEY, of St. Paul's Road, Canonbury, and STEPHEN CHARLES LACEY, of Canonbury Park Square, both in the co. of Middlesex, for "*An improved apparatus for stopping the flow of gas through a meter when any determined quantity has been supplied.*" Aug. 26, 1870.

2354.—THOMAS CLAYTON, of Manchester, in the co. of Lancaster, mechanic, and WILLIAM HENRY BAILEY, of the Albion Works, Salford, in the same co., brassfounder and turret-clock maker, for "*Improvements in apparatus for producing inflammable gas from mineral and other oils, parts of which are applicable for heating purposes.*" Aug. 27, 1870.

2361.—EDMUND CHIVERTON, of Orient Cottage, Middle Street, Southsea, in the co. of Hampshire, for "*A self-acting lamp-lighter.*" Aug. 29, 1870.

2377.—THOMAS ATKINS, of St. Albans, in the co. of Herts, for "*Improvements in economizing the waste heat and gases from furnaces, and in generating, collecting, and purifying gases, such gases being applicable to various useful purposes.*" Aug. 31, 1870.

2383.—ISHAM BAGGS, of High Holborn, in the co. of Middlesex, scientific chemist and engineer, for "*Improvements in steam and gas engines.*" Sept. 1, 1870.

2384.—CHARLES HENRY CHADBURN and WILLIAM CHADBURN, of the firm of Chadburn and Son, of Liverpool, in the co. of Lancaster, opticians and philosophical instrument makers, for "*Improvements in mechanical telegraphs and liquid to be used therewith, which fluid is also applicable as a power transmitter; for other purposes for the making of liquid joints, and other purposes where it is desirable to use a liquid that does not readily congeal or evaporate.*" Sept. 1, 1870.

2398.—JOHN WARD GIRDLESTONE, of 37, Norfolk Street, Strand, in the co. of Middlesex, for "*Improvements in 'dry' closets, commodes, urinals, and other receptacles for putrescible matter.*" Sept. 2, 1870.

2416.—WILLIAM WALKER, of the city of Manchester, engineer, for "*Improvements in propellers, pumps, and blowers.*" Sept. 6, 1870.

2418.—ANDREW M'NIEL, of Tiverton, in the co. of Devon, engineer, and WILLIAM WHEATON, of Exeter, in the same co., merchant, for "*Improvements in the manufacture of salts of ammonia from ammoniacal gas liquor.*" Sept. 6, 1870.

2422.—THOMAS MURRAY GLADSTONE, of York Buildings, in the city of Westminster, mechanical engineer, for "*Improvements in chimney-tops and ventilators.*" Sept. 6, 1870.

2426.—CORNELIUS WILLIAM MORLEY, of 42, Clifton Road East, St. John's Wood, London, for "*Improvements in gas-burners and in the construction of the same.*" Sept. 7, 1870.

2433.—JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the co. of Middlesex, gentleman, for "*Improvements in pipe-joints or couplings, applicable also to couplings for rods and shafting.*" A communication. Sept. 8, 1870.

2434.—TREAT TIMOTHY PROSSER, of Chicago, Illinois, U.S.A., engineer, at present residing at 198, St. Vincent Street, Glasgow, in the co. of Lanark, N.B., for "*A new or improved tube-expander and tube-cutter combined.*" Sept. 8, 1870.

GRANTS OF PROVISIONAL PROTECTION.

2242.—WILLIAM OLIVER JOHNSTON, of the town and co. of Newcastle-upon-Tyne, engineer, for "*Improvements in the production of cast-iron pipes, columns, and other similar castings.*" Aug. 12, 1870.

2338.—ALFRED VINCENT NEWTON, of 66, Chancery Lane, in the co. of Middlesex, mechanical draughtsman, for "*Improvements in liquid-meters.*" A communication. Aug. 25, 1870.

2344.—FREDERICK GRAY, of Birmingham, in the co. of Warwick, manufacturer, for "*Improvements in gas-lamps and other lamps.*" Aug. 26, 1870.

2350.—THOMAS LACEY, of St. Paul's Road, Canonbury, and STEPHEN CHARLES LACEY, of Canonbury Park Square, both in the co. of Middlesex, for "*An improved apparatus for stopping the flow of gas through a meter when any determined quantity has been supplied.*" Aug. 26. 1870.

2354.—THOMAS CLAYTON, of Manchester, in the co. of Lancaster, mechanic, and WILLIAM HENRY BAILEY, of Albion Works, Salford, in the same co., brassfounder and turret-clock maker, for "*Improvements in apparatus for producing inflammable gas from mineral and other oils, parts of which are applicable for heating purposes.*" Aug. 27, 1870.

NOTICES TO PROCEED.

1180.—CHARLES LUNGLEY, of Greenwich, in the co. of Kent, hydraulic engineer, for "*Improvements in the manufacture and in the securing of tubes, taps, and plugs in boilers and other vessels; also in certain modes of regulating and stopping the flow of liquids, gases, or air into or from such vessels.*" April 22, 1870.

1240.—VICTOR BABLON, of 40, Rue du Roi de Sicile, in the city of Paris, in the empire of France, for "*An improved apparatus for regulating the pressure of gas in gas-burners.*" April 30, 1870.

1300.—EDWARD THOMAS KIRKPATRICK, of Brussels, in the kingdom of Belgium, doctor of natural science, for "*A new or improved mode of producing oxygen gas at the ordinary temperature of the air or at a higher temperature.*" May 6, 1870.

THE

DUKE OF HAMILTON'S

LESMAHAGOW

CANNEL COAL.

LESSEES:

THE NITSHILL & LESMAHAGOW COAL COMPANY.

OFFICE:

37, ST. VINCENT PLACE,

GLASGOW,

Where all communications are requested to be addressed.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	13 — 14
1000	20	Do., preference	20 0 0	10 0 0	25 — 27
750	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	4 10 0	5⅜ — 6
10000	5	Do., third issue	4 0 0	4 10 0	4⅝ — 5
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge, & Holywell.)	20 0 0	10 0 0	30 — 31
7500	20	Cagliari (Limited)	20 0 0	7 0 0	
112000	10	*Chartered*, A shares	10 0 0	8 0 0	12½ — 13
8000	10	Do., do.	5 0 0	8 0 0	6½ — 6⅝
10000	10	Do., B shares, 4 per cent. max.	10 0 0	4 0 0	6¾ — 7
25000	10	Do., 5 per cent. preference	2 0 0	5 0 0	3 — 3½
20000	10	Do., 10 per cent. preference	10 0 0	10 0 0	18 — 19
17490	25	*Commercial*	25 0 0	10 0 0	38 — 40
20000	20	Continental Union	20 0 0	8 0 0	25 — 27
10000	10	Do., new	5 0 0		7¼ — 8⅛
5213	20	Do., preference	20 0 0	7 0 0	25 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16 — 16½
5000	10	Do., preference	10 0 0	6 0 0	11 — 11½
10000	10	Do., new shares	10 0 0	7 0 0	12 — 12⅝
4000	50	*Equitable*	50 0 0	10 0 0	82 — 84
4000	25	Do., new shares	25 0 0	10 0 0	41 — 42
23406	10	European (Limited)	10 0 0	11 0 0	16 — 16¼
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	11 0 0	7¼ — 8
5000	10	Hong Kong (Limited)	10 0 0	9 0 0	11 — 12
26000	50	*Imperial*	50 0 0	10 0 0	80 — 81
26000	10	Do., new shares	7 0 0	10 0 0	12½ — 13
26000	12½	Do., new shares	12 10 0	7 0 0	14 — 15
1300	100	Do., bonds	£100	10 0 0	175 —180
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	9 2 6	60 — 62
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	64 — 65
3000	10	Do.	10 0 0	5 0 0	7 — 9
3000	20	Do.	15 0 0	7 10 0	17 — 18
7133	50	*London*	50 0 0	10 0 0	80 — 82
5610	25	Do., 1st preference	25 0 0	6 0 0	27½ — 28
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
		Nictheroy, Brazil (Limited)			
15000	5	Malta and Mediterranean (Limited)	5 0 0	4 10 0	3½ — 4
6000	5	Do., preference	5 0 0	7 0 0	4⅞ — 5¼
		Mauritius (Limited)			
30000	5	Oriental (Calcutta)	5 0 0	10 0 0	8 — 8½
30000	5	Do., new shares	1 10 0	10 0 0	3 — 3¼
10000	5	Ottoman (Limited)	5 0 0	nil.	2 — 2¼
14000	10	Park (Limited)	10 0 0	10 0 0	10 — 11
27000	20	*Phœnix*	20 0 0	10 0 0	31 — 32
3600	100	Do., new	40 0 0	7 10 0	46 — 46½
144000	8k.	*Ratcliff*	100 0 0	5 0 0	82 — 84
5000	20	*Rateliff*	20 0 0	10 0 0	27 — 28
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	27 — 28
6959	5	Singapore (Limited)	5 0 0	7 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
1500	32½	Shanghai	32 10 0	12 0 0	
4000	50	*South Metropolitan*	50 0 0	10 0 0	86 — 88
4000	12½	Do.	12 0 0	10 0 0	20 — 21
20000	12½	Do., new shares	1 1 0	10 0 0	3⅞ — 4¼
15000	10	*Surrey Consumers*	10 0 0	10 0 0	15 — 16
10000	10	Do., new	6 0 0	10 0 0	10 — 10½
9000	4	United General (Limerick)	4 0 0	5 0 0	2¼ — 2⅜
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	10 — 12
1500	10	Do.	10 0 0	7 10 0	
1819	10	Do.	10 0 0	7 10 0	
1138	10	Do.	5 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	16 — 17
10000	10	Do., B shares	8 0 0	10 0 0	14½ — 15
10000	10	Do., C shares	8 0 0	10 0 0	13 — 13½
20000	10	Do., D shares	1 0 0	10 0 0	2½ — 3
16000	5	*West Ham*	5 0 0	7 10 0	7 — 7¼
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle and Middlesboro'.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 17 6	2 12 6	2 11 0	3 10 0	3 15 0
1¼ and 2-inch Socket-pipes	7 0 0	5 15 0	5 10 0	6 0 0	7 0 0
2½ and 3-inch ditto	6 10 0	5 5 0	5 0 0	5 15 0	6 10 0
4 and 5-inch ditto	6 0 0	4 15 0	4 10 0	5 5 0	6 0 0
6 inches and upwards ditto	5 15 0	4 5 0	4 0 0	5 0 0	5 15 0
Retorts, 1st fusion, hot blast	5 10 0	4 10 0	4 5 0	5 0 0	5 10 0
Ditto, 2nd ditto, cold ditto	6 10 0	—	—	—	6 10 0
Tank-plates, ¼ thick and above	6 0 0	5 0 0	4 15 0	5 10 0	6 0 0

WROUGHT-IRON TUBING,

Subject to 60 per cent. Discount.

	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 14 feet—per foot	1 8	1 1	0 10	0 7	0 5	0 4½
Ditto ditto, from 12 in. to 23½ in.—each	3 0	2 0	1 6	1 1	0 9	0 8
Long Screws, from 12 in. upwards	4 0	2 3	2 0	1 6	1 2	0 11
Bends and Springs	4 3	2 3	1 9	1 3	0 11	0 8
Square Elbows, equal or reducing; Round Elbows, 5 per cent. extra	3 9	2 3	1 9	1 3	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 9
Crosses, ditto, equal or reducing	4 9	3 6	2 9	2 3	1 9	1 6
Iron Cocks	20 9	13 0	10 0	7 3	5 0	3 8
Ditto, with brass plug	26 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4½
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2-quart	15 0	14 0	13 6	13 0	13 0	—

GAS COALS.

	Per Ton.
Newcastle—Unscreened:—	6s. 6d.
Haswells, Nettlesworth Primrose, and South Pelaw	
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7
Pearth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Pearth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	15 0
Wigan Cannel (at Liverpool)	17 0
Welsh Cannel:—	
Coppa Cannel (on rails at Birkenhead), 13s. 6d.; ditto (on rails at Connah's Quay)	13 0

Scotch Cannel, f.o.b.:—	Per Ton.	*Scotch Cannel*, f.o.b.:—	Per Ton.
Boghead—at Bo'ness, 47s. 6d.; at Leith 48s. 3d		Arniston (at Leith)	21s. 0d
Muirkirk	27 0	Wemyss (at Wemyss')	20 0
Kirkness, best (at Burntisland)	22 6	Haywood Co.'s Haywood (at Granton)	20 0
Capeldrae, 1st quality (at ditto)	22 6	Pirnie, or Methil	17 0
Ditto, 2nd ditto (at ditto)	17 6	Lothian's Cannel (at Leith)	24 6
Cowdenbeath (at ditto)	12 0	Grange ditto (at Bridgeness)	17 6
Lochgelly (at ditto)	13 0	Kinniel ditto (at Bo'ness)	17 6
Donnibristle—at Burntisland, 12s.; at Aberdour	12 6	Myles' ditto	23 6
Auchinheath Lesmahago (at Granton)	27 0	Lochore Parrot (at Burntisland)	22 6
Nitshill and Lesmahago Coal Company (at Granton)	27 6	Lanemark (at Glasgow)	16 0
		Elphinstone Tower (at Leith)	20 0

FREIGHTS.

Coastwise—Newcastle:—	Per Ton.	*Foreign:*—	Per Keel.
Chatham and Rochester	6s. 3d	Barcelona	£20 0s
Cork	5 4	Bordeaux	12 0
Dover, Folkestone, and Ramsgate	6 6	Boulogne and Calais	8 0
Dublin	8 6	Cadiz	13 0
Exeter Quay	8 6	Cronstadt	9 0
Ipswich	5 6	Copenhagen	8 0
London (from Leith)	9 0	Genoa	17 6
London (Pool)	6 3	Hamburg	—
Lowestoft and Yarmouth. 4s. 9d. to	5 0	Havre de Grace	10 0
Portsmouth & Southampton	8 0	Leghorn	18 0
Plymouth	8 6	Lisbon	13 0
Shoreham	7 9	Rotterdam	8 0
Whitstable	6 9	Stettin	—
Weymouth	7 9	Trieste	20 0
		Venice	21 0

SUNDRIES.

Best Newcastle Fire-bricks, per 1000	£2 10s. to £2 15s. 0d.
Cliff's Fire-bricks (at Wortley), per 1000	2 15 6
Ingham's ditto (at Wortley), per 1000	2 15 0
Farnley Iron Co.'s Fire-bricks (at Wortley), less discount	2 17 0
Fire-clay Retorts, per foot run	5s. 6d. to 0 7 6
Tarred Rope Yarn, per cwt.	1 0 0

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

ECONOMY IN GAS PURIFICATION. A PURER GAS AT LESS COST, AND GREAT SAVING IN LABOUR.

M'DOUGALLS' PRECIPITATED PEROXIDE OF IRON.

The above Oxide is now in use at some of the largest works in the kingdom, and has gained a decided preference, owing to its efficiency, cheapness, and the great saving in labour effected by its use.

It is a pure artificial Hydrated Peroxide, with an addition of only sufficient sawdust to give it the needful lightness or porosity to prevent pressure, and every particle is available for use.

In selecting an oxide, a point more important than its price, is to learn the cost of labour entailed in its use. Whilst at large works the cost of labour for purifying, where lime alone or the natural oxides are employed, is 2d. to 3d. per ton of coals, by the use of the above Oxide it is reduced to 1d. to 1½d., owing to the purifier's working so much longer when charged, and to rapid revivification—two points of special importance in the busy season.

For export to Foreign Works it is unequalled, every particle being available, and saves freight over less concentrated materials.

NOTE.—It is important to note that only the Hydrated Peroxide of Iron is useful, simple oxide being worthless. Inferior oxides show a large per centage of simple oxide, but very little Hydrated Peroxide.

M'DOUGALL BROTHERS,

LONDON—11, ARTHUR STREET WEST, LONDON BRIDGE, E.C. MANCHESTER—88, PORT STREET.

LOOE GAS-WORKS.

WANTED, a Manager for the Works. Wages 20s. per week. House, firing, light, and water free.

Applicants must have a thorough knowledge of the manufacture of gas and service-laying.

Apply to the Secretary, C. BAWDEN, LOOE.

WANTED, a situation as Head Stoker in a Gas-Work. Well understands the working of an engine and exhauster, or can undertake a small Gas-Work without fitting. Can have good character from last place.

Apply to Mr. JAMES SMITH, Gas-Works, Wellington, SALOP.

WANTED, by a young Man, aged 21, a situation as CLERK or ASSISTANT to an Engineer. Has been for nearly five years in a Gas-Work in the Midland Counties. Can give unexceptionable references, and find any reasonable amount of security.

Apply to C. B. J., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a first-class Working MANAGER. Must be thoroughly acquainted with the setting and working of clay retorts, the use of an engine and exhauster, and the general management of a moderate-sized Gas-Work. A comfortable house on the works, with a small garden, coal, and gas found.

Applicants will be required to produce testimonials as to character, and state wages required.

For further particulars, apply to Mr. F. W. OLDFIELD, Secretary and Manager, Gas-Works, Sutton, Southcoates and Drypool, HULL.

WORKING MANAGER.

WANTED, a situation as above by an experienced Man, aged 31, used to main-laying and the fitting up of Gas-Works. Good references from present and former employers for ability and attention.

Address G. H., Mr. Miell, Trayloe Cottages, Hanwell, MIDDLESEX.

TO GAS COMPANIES.

WANTED, by a Man aged 32, a situation as GAS-FITTER and METER INSPECTOR. Has had experience in the repairing and testing of meters, can take indexes and attend to complaints; understands fitting in all its details, and can lay services. Satisfactory reference from Gas Company.

Address J. G., 5, College Street, College Green, BRISTOL.

WANTED, by an experienced and practical Working Manager, a RE-ENGAGEMENT in Gas-Works. Has had many years experience in erecting Gas-Works at home and abroad, and thoroughly understands making and distributing gas. Good testimonials.

Address W. M. C. Y., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS-METER MANUFACTURERS.

MR. T. B. Denham, representative for many years to the late Thomas Glover, London, is open to an engagement as TRAVELLER. Thorough knowledge of the trade, and good connexion.

Address Abercorn Villa, Mount Pleasant, Joppa, near EDINBURGH.

TO GAS COMPANIES AND ENGINEERS.

THE Advertiser, who has just returned from abroad, after completing the erection of a large Gas-Work, is open to a RE-ENGAGEMENT in a similar capacity, or as MANAGER for an English Gas Company. Has had 14 years practical experience (home and foreign) in the management, erection, and reconstruction of all plant appertaining to Gas-Works. Satisfactory references given to engineers and Gas Companies. Speaks the Spanish language, and has a good knowledge of Portuguese and Italian. Aged 34 years.

Address J. G. O. F., 98, Malden Road, Haverstock Hill, LONDON.

A Civil Engineer who has a knowledge of gas work, and wishes to obtain thorough practical experience, would give his services for a term to an Engineer of large works. Has had much experience in foundations and hydraulic work generally.

Address Mr. EVENS, The Werfa, ABERDARE.

ROBERT MACLAREN and CO., EGLINTON FOUNDRY, GLASGOW, Manufacturers of all sizes of Cast-Iron Main-Pipes by an improved Patent, General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that an ORDINARY MEETING of the PROPRIETORS of this Company will be held at the London Tavern, in the City of London, on MONDAY, the 3rd day of October next, at Two o'clock precisely, to receive the Directors Report, and the Accounts of the Company for the half year ended June 30 last, and to declare a Dividend for the same period.

By order of the Board,
THOS. LIVESEY, Secretary.

Old Kent Road, Sept. 10, 1870.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the London Tavern, Bishopsgate Street, in the City of London, on THURSDAY, the 29th inst., to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, to declare a Dividend, and for general business.

The Chair will be taken at Half-past Three o'clock precisely. By order of the Board,
MAGNUS OHREN, Secretary.

Offices, Lower Sydenham, S.E., Sept. 2, 1870.

SURREY CONSUMERS GAS COMPANY.

NOTICE is hereby given that the HALF-YEARLY ORDINARY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the Bridge House Hotel, London Bridge, Southwark, on THURSDAY, the 13th day of October next, at Three o'clock in the afternoon precisely, to receive the Directors Report for the half year ending the 30th of June last, and to declare a Dividend.

The Books for the Transfer of Shares will be closed on the 24th of September, until after the Meeting.

Rotherhithe, Sept. 5, 1870.

COMMERCIAL GAS COMPANY.

NOTICE is hereby given that the next ORDINARY MEETING of the Company will be held at the London Tavern, Bishopsgate Street, in the City of London, on FRIDAY, the 7th day of October next, at Twelve o'clock at Noon, to receive the Report of the Directors, and to declare a Dividend to the 30th day of June last.

The Books of the Company will be closed for the Transfer of Shares from the 23rd day of September to the 7th day of October now next ensuing.

By the Company's Act of Incorporation, Shareholders can inspect the Books of the Company during one fortnight before and one month after the Meeting.

By order of the Board,
GEORGE JAQUES, Secretary.

Stepney, Sept. 9, 1870.

W. J. SIMMONDS,

Retort and Boiler Setter and Contractor for Gas-Works in general,

7R, SOUTH STREET, NEW NORTH ROAD, ISLINGTON, LONDON, N.

Upwards of 16 years Retort Setter to the Chartered Gas Company, Brick Lane and Curtain Road Stations.

Materials supplied on reasonable terms if required, or labour only.

No connexion with any other Retort Setter.

N.B.—Orders to be addressed as above.

TO BRIDGE BUILDERS, CONTRACTORS, AND OTHERS.

THE Directors of the Imperial Gaslight and Coke Company are prepared to receive TENDERS for the construction of a bridge over the River Lea and Bow Creek, at Bromley, Middlesex.

Specifications, plans, and all further information, may be obtained on and after the 10th inst., of Peter W. Barlow, Esq., C.E., at 26, Great George Street, Westminister.

Sealed tenders, endorsed "Tender for Bridge," to be sent in not later than Eleven o'clock a.m., on Friday, the 30th inst., addressed to the undersigned.

The Directors do not bind themselves to accept the lowest or any tender.

HARRY CHUBB, Secretary.

Imperial Gaslight and Coke Company,
33, John Street, Bedford Row, London, W.C.,
Sept. 1, 1870.

FOR SALE, a Station Gas-Meter, capacity 10,000 cubic feet per hour (maker, Milne and Son, Edinburgh), with 1 10-in. Cathels's patent four-way disc-valve. Can be seen working. Cause for removal—to be replaced by larger meter.

Apply to Mr. DAVID BARCLAY, Engineer, Gas-Works, TOTTENHAM, N.

CONDENSER & PURIFIERS FOR SALE.

ONE Set of 3 Dry Lime Purifiers, 6 ft. by 6 ft., and 3 ft. 9 in. deep, with 6-in. connexions, wet centre-valve, wood grids, and lifting apparatus all in good working order. Also One CONDENSER, with 16 5-in. pipes, each 12 ft. long, top and bottom syphon-boxes, and 7-in. connexions; together with a Station-Meter to pass 2000 feet per hour, and an Hydraulic Main 20 ft. long by 14 in. diameter, with 9 4-in. bridge-pipes. The above will be sold either in one lot or separately, and no reasonable offer refused. JOHN CREW, Manager.

Gas-Works, Blackpool, Lancashire,
Aug. 20, 1870.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, E.C., and 138, Regent Street, LONDON. Agents wanted.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,

SCOTSWOOD FIRE-BRICK WORKS, NEAR BLAYDON-ON-TYNE.

B. CARPENTER'S

IMPROVED

WOOD SIEVES FOR GAS PURIFIERS.

WORKS:

14, JOHN STREET, PENTONVILLE ROAD, LONDON, N.

The above Sieves are used by the principal Gas Companies in London and the country. Their utility, durability, and cheapness combined, render them superior to all others.

Testimonials from Gas Engineers who have tested their qualities forwarded on application.

All orders punctually attended to, and estimates given if required.

Established 1811.

READY & SON,

BILSTON STREET BRASS FOUNDRY,

WOLVERHAMPTON

MANUFACTURERS OF

SUN BURNERS, GAS CHANDELIERS, HALL LANTERNS, BRACKETS, PENDANTS,

And every Description of

GAS-FITTINGS,

Including

MEDIÆVAL FITTINGS FOR CHURCHES, &c

Large Pattern-Books complete, with Book of Prices, 7s. 6d.

THOMAS BEAR,

MICA, TALC, AND ASBESTOS MERCHANT,

233, HIGH STREET, BOROUGH, LONDON.

MICA CUT TO ALL SIZES.

SWANWICK CANNEL.

The yield of this Cannel is liberal, the illuminating power large, and coke good.

For prices and terms, apply to

H. BOAM, 1, Darwin Terrace, DERBY.

ALFRED LASS,

ACCOUNTANT.

28, NORTH STREET, WANDSWORTH, S.W.

Mr. Alfred Lass having had considerable experience in arranging, making up, balancing and auditing gas accounts, begs to inform the Directors of Gas Companies that he may be consulted on all matters relating thereto.

Balance-sheets prepared, Accounts audited, Consultations, Agencies, &c.

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large Stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all Sizes kept in London at Mr. ALFRED WILLIAMS, Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—Export orders continue to have prompt attention.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

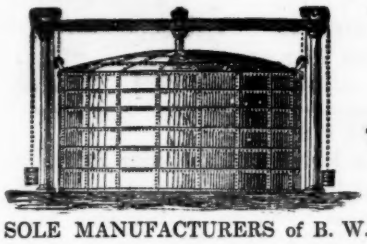
296, ROTHERHITHE, LONDON, S.E.

This Paint having been in general use over eight years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

INVENTED AND MANUFACTURED BY

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportation.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

Prospectus, Price Lists, &c., on application.

LONDON OFFICES—57, GRACECHURCH STREET, CITY.

*** *Please address letters to Huddersfield.*

REFERENCES TO NEARLY 300 GAS-WORK

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

IMPROVED WET & DRY CONSUMERS GAS-METERS,

GAS STATION-METERS,

With all the Joints planed,

GOVERNORS, GAUGES, INDICATORS, EXHAUST GOVERNORS, &c.

TERMS, &c., ON APPLICATION.

Established 1827. Established 1827.

WILLIAM & BENJAMIN COWAN,

WET & DRY GAS-METER MANUFACTURERS, BRASSFOUNDERS, &c.

STATION-METERS with PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, TEST GASHOLDERS, GAUGES, &c.

BUCCLEUCH STREET WORKS, EDINBURGH.

Sole Manufacturers of ESSON'S PATENT COMPENSATING GAS-METER,

AND OF

COWAN'S PATENT SIDE-VALVE GAS-METER,

All of which may be had with

NEWBIGGING and HINDLE'S "PATENT AIR-TIGHT INDEX-BOX,"

Of which W. & B. C. are the Sole Manufacturers.

W. & B. COWAN'S DRY GAS-METERS, in CAST-IRON CASES,

Possess a simplicity of construction and facility for repair greater than any yet produced, while the excellence of the material and workmanship, and accuracy of registration, cannot be surpassed. The superiority of their Dry Meters in Tin Cases is also well known, having stood the test of years.

PRICE LISTS ON APPLICATION.

CANNEL COAL.—The West Yorkshire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Hugron, Esq., F.C.S.:

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz.—

Yield of gas	10,416 cubic feet.
Illuminating power	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas	10,080 cubic feet.
Illuminating power	14·41 sperm candles.
Yield of coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles.*

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

OLD WEMYSS CANNEL COAL.—Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to Mr. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS,
COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

THE
HUCKNALL COLLIERY COMPANY
Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

THOMAS EDINGTON & SONS,
PHŒNIX IRON-WORKS,
GLASGOW,
Manufacturers of all kinds of
GAS AND WATER PIPES,
Branches, Bends, Water-Traps, Tank-Plates, Valves, and general Castings. Also
RAILWAY CHAIRS & SLEEPERS,
AND
GRIFFIN'S PATENT PERMANENT WAY.
London Office, 63, Old Broad Street.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST IRON GIRDERS.
DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.

FIRE-CLAY GAS-RETORTS, &c., CANNEL AND STEAM COALS.

WILLIAM FRASER, Inverkeithing (owner of the Works at which Fire-Clay Retorts were first made), having greatly enlarged his Works, can supply RETORTS and other FIRE-CLAY GOODS to any extent.

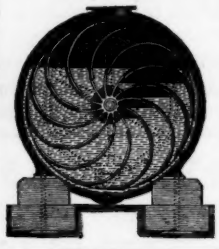
References can be given to managers of above a hundred Gas-Works whom he supplies.

WILLIAM FRASER ships COWDENBEATH PARROT COALS at Charlestown and Burntisland at 11s. per ton; and HALBEATH STEAM COALS, on Navy List, at 7s. per ton.

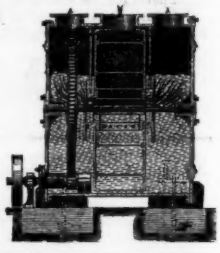
INTERNATIONAL EXHIBITION, 1862.
CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.
WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

J. T. B. PORTER & CO.,
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR GAS-WORKS
Of any extent at Home and Abroad,
GOWTS BRIDGE WORKS, LINCOLN,
AND
JOHN STREET, ADELPHI, LONDON, W.C.

WALTER FORD,
159, GRAY'S INN ROAD, LONDON,
MANUFACTURER OF
WET & DRY GAS-METERS, STATION-METERS, GOVERNORS, &c.
SOLE MANUFACTURER OF
PADDON'S PATENT STREET-LAMP REGULATORS,
For ensuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.



HANNA DONALD & WILSON
GAS ENGINEERS,
ABBEY WORKS, PAISLEY.
LONDON OFFICE:
9, FENCHURCH STREET, E.C.
MAKERS OF
WHIMSTER'S PATENT COMBINED GAS
EXHAUSTING & WASHING MACHINE.
Information and prices on application.



ROBERT DEMPSTER,
Gas Engineer and Contractor, Rose Mount Foundry, Elland, near Halifax.

R. D. recommends his Fire-Brick Retorts to Engineers and Managers of Gas Companies; they last from 10 to 12 years.

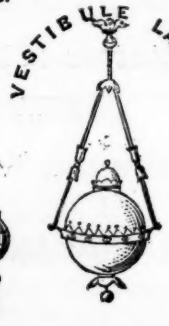
Iron and Fire-Clay Retorts.	Wrought-Iron Tubes, Water Tanks.
Annular and Pipe Condensers.	Wrought-Iron & Cast-Iron Roofs.
Scrubbers and Purifiers, all sizes.	Gasholders, Single-Lift or Telescopic.
Steam-Engines and Exhausters.	Gas Castings of every description.
Hydraulic Centre-Valves.	Retort Setters and Fitters sent to all parts of the country.
Station-eMters and Governors.	Wood Sieves for Purifiers.
Photometers & Pressure-Gauges.	
Lamp-Posts and Brackets.	
Cast-Iron Mains and Syphons.	

Plans and Specifications prepared.

WILLEY & FORD,
GAS ENGINEERING WORKS, EXETER,
CONTRACTORS FOR THE ERECTION OF GAS-WORKS,
MANUFACTURERS OF IMPROVED WET & DRY METERS;
Also, EVERY DESCRIPTION OF GAS APPARATUS,
Comprising GASHOLDERS, STATION-METERS, GOVERNORS, CONDENSERS, PURIFIERS, RETORTS, SLIDE-VALVES, and every article appertaining to Gas-Works.
Gas Companies advised on Improvements, Extensions, and Alteration of Works.
*** The very best material and workmanship guaranteed, and at prices bearing a favourable comparison with any House in the Kingdom.

SAMUEL CUTLER & SON,
CONTRACTING GAS ENGINEERS, &c.
MANUFACTURERS OF GASHOLDERS, TANKS, PURIFIERS,
AND ALL DESCRIPTIONS OF GAS-MAKING APPARATUS.
Iron Roofs, and General Iron Work. Mains Supplied and Laid.
S. C. & SON supply every requirement for a Gas-Work, and keep in stock Retort-Lids, Cotters, Barrows, Scoops, Bolts and Nuts, &c., &c.
PROVIDENCE IRON-WORKS, MILLWALL, LONDON, E.

TO GAS COMPANIES AND THE TRADE.
J. DEFRIES & SONS,
MANUFACTURERS OF
CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN
LIGHTS, AND THE PATENT CRYSTAL ILLUMINATION;
Vestibules, Iron Barrel, Composition Tubing, Dry & Wet Meters, & Gas-Fittings
OF EVERY DESCRIPTION.
WORKS: LONDON, BIRMINGHAM, & PARIS.
REGISTERED DESIGNS.



Special Designs prepared in perfect accordance with architectural arrangements. Estimates furnished for the Lighting and Fitting up of Theatres, Music Halls, and Public or Private Buildings with Gas.

GAS MOONS of the newest designs.

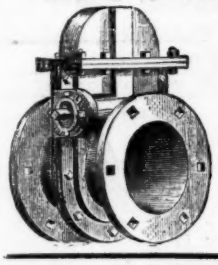
The Patent Gas-Regulator and Purifier reduced to 6s. 6d. per Doz.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1870, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.
ESTABLISHED 1803.

REDUCED PRICES
OF
B. DONKIN & CO.'S
IMPROVED GAS-VALVES
WITH WROUGHT-IRON PINIONS,

From 2 inches to 18 inches, price 9s. 6d. to 12s. per inch diameter.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.

VALVES MADE WITH OUTSIDE RACKS TO ORDER.

ALSO,

SCREW WATER-VALVES WITH GUN-METAL FACES.

B. DONKIN & CO.,

GENERAL ENGINEERS AND IRONFOUNDERS,

MAKERS OF STEAM-ENGINES,

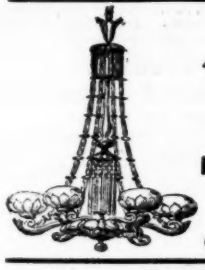
BERMONDSEY, LONDON, S.E.

A. C. FRASER, F.S.A.,
GAS AND CONSULTING ENGINEER,
COLCHESTER, ESSEX,

INVENTOR & PATENTEE of CAST-IRON & FIRE-CLAY RIBBED RETORTS.

Mr. Fraser having had more than Twenty years experience in the Construction, Alteration, and Management of GAS and WATER WORKS, will be happy to furnish information on all matters appertaining thereto.

Plans, Specifications, and Estimates prepared.



F. & C. OSLER,
45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

JAMES MILNE & SON,
GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Station-Meters, Governors, Consumers Meters, Gas Lustres, Chandeliers, Brackets, &c., and every description of Gas-Fittings and Gas Apparatus.

GEORGE ANDERSON,
GAS AND CONSULTING ENGINEER,

19, NORTHUMBERLAND STREET, STRAND, W.C.

MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and EXHAUSTERS, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.
BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

SCHOLL'S
PATENT PLATINUM
GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

Price 1s. each for Fishtail Burners.

To be had retail of Gas-Fitters and Ironmongers, and wholesale of

JOHN SCHOLL, 41 & 42, BERWICK STREET, OXFORD STREET,
LONDON, W.

Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.

*** Further testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention will be shortly published.

PRICE'S PATENT COKE & COAL BARROW,

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Gas-Works, HAMPTON WICK.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,

SUPPLY GAS & WATER PIPES of EVERY SIZE.

Plain, Turned and Bored, and Coated.

CAST-IRON RETORTS.

Castings for Gas-Works of every description.

EXHAUSTERS.

LONDON OFFICE: 95, CANNON STREET.

NAPHTHALINE
IN GASHOLDER INLET-PIPES.

With Livesey's Patent Man-Lid these Pipes can be examined and cleansed without loss of Gas, with the greatest facility and without any risk.

Cost of the Apparatus, to cover two 18-in. pipes, about £10.

Royalty: At the rate of 1s. per foot diameter of each Gasholder, and no further payment.

LIVESEY'S SYSTEM OF WATER-VALVES
FOR PURIFIERS

Will effectually prevent that contamination of the pure Gas which so frequently occurs where the ordinary Valves are used. They are much less costly, easily applied, and, being simple castings, cannot well get out of order, while by their use it is found that the Gas will bear a continuous test for Sulphuretted Hydrogen for an indefinite time.

Application to be made to the Patentee, GEORGE LIVESEY, Engineer, South Metropolitan Gas-Works, S.E., where both inventions are in use.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101, Cann Street, E.C.

THOMAS LAMBERT & SONS,
SHORT STREET, LAMBETH, LONDON,

PATENTEES OF THE

HIGH-PRESSURE EQUILIBRIUM BALL VALVES AND DIAPHRAGM BIB & STOP VALVES,

MANUFACTURE EVERY DESCRIPTION OF

GAS-JOINTS, CHANDELIERS, PENDANTS, BRACKETS, ETC.;

WROUGHT-IRON

WELDED TUBE AND FITTINGS,

BLACK AND GALVANIZED;

BRASS, COPPER, LEAD, TIN, AND COMPOSITION TUBING,

STOCKS, TAPS, AND DIES,

And Every Description of Gas-Fitters Tools;

CAST-IRON GAS-MAIN COCKS,

WITH PATENT METAL PLUGS;

GAS SLIDE AND SLUICE VALVES;

CARTER'S SAFETY GAS-VALVES;

GAS-STOVES, REGULATORS, BURNERS, &c.,

Large Pattern-Book and Price List of Gas-Fittings, price 7s. 6d., supplied on application.

JAMES NEWTON & SONS,
(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

SOUTHWARK, LONDON, S.E.,

DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

T. EVANS & SONS, Retort-Setters and GAS-OVEN BUILDERS, having done the work at various Gas-Works in England and Wales for many years, can be well recommended. Testimonials and references on application.

Communications to be addressed to the Gas-Works, Cannock, near STAFFORD.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET EDINBURGH.
Established 1840.

Now publishing,

BAILEY'S ILLUSTRATED INVENTIONS,

With Illuminated Cover and over 300 Engravings.

Price 1s.

This book is replete with information, and prices of many well-known as well as perfectly new inventions, interesting to all in the mechanical trades, as well as corporations, governments, gas managers, private gentlemen, and shopkeepers.

Post free in the United Kingdom, 1s.

JOHN BAILEY AND CO., Albion Works, Salford, LANCASHIRE.

TURNER & ALLEN,

201, UPPER THAMES STREET

LONDON, E.C.

MANUFACTURERS OF

LAMP PILLARS,

BRACKETS,

GAS LANTERNS,

FOUNTAINS.

HOT WATER AND GAS ENGINEERS.

Contractors for the supply of Lamp Columns, Lamps, Fountains, &c., to Gas, Water, and Railway Companies, Local Boards, Shippers, &c.

Complete Pattern and Price Book, 3s. 6d. in Stamps.

THOMAS PROUD,

GAS ENGINEER,

Invites attention to his

ALL-PLANED PARALLEL & TAPER BAR

WOOD GRIDS

FOR PURIFIERS,

And respectfully states that he has erected improved Steam Machinery for their manufacture, and devotes great care to manufacture Grids which will give satisfaction both in quality and price.

He also solicits attention to his

IMPROVED GAUGE

which indicates pressure or vacuum in ONE TUBE, the supported or depressed column of water giving the exact reading at a single glance. Mounted on a neat mahogany bracket, and having but one joint, the Gauge can be taken asunder, cleansed, and refixed in a few minutes.

Plans and estimates furnished for improvement of existing, or for the erection of new Gas-Works.

Sole Agent to

GEORGE SKEY & COMPANY,

Limited,

For FIRE-CLAY RETORTS.

Gas Apparatus Manufactory,

7, UNETT ST., ST. GEORGE'S,

BIRMINGHAM.

C. & W. WALKERS'

WOOD SIEVES FOR PURIFIERS.

These justly celebrated Sieves, with bevel bars and hard-wood side frames, have been extensively made by Messrs. Walker for over seven years, and their advantages and durability are fully established. Messrs. Walker make them in very large quantities, having mills and machinery specially laid out for them, producing them at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON, E.C.

HANCOCK'S INDIA-RUBBER GAS-TUBING.

All sizes, from ⅛ in. to 4 in. diameter and upwards.

Also,

HORSE SINGEING APPARATUS, best make, with GAS-BURNERS, COMBS, and INDIA-RUBBER TUBING, all complete.

INDIA-RUBBER BAGS for GAS-MAINS.

WASHERS for GAS and STEAM JOINTS.

VALVES (pure solid Rubber) for STEAM-ENGINES.

PACKING (Elastic) for STEAM-ENGINES.

FLANGE TUBING, for excluding Draughts and Dust through WINDOWS, DOORS, and GLASS CASES.

Section.

Illustrated Price Lists on application.

JAMES LYNE HANCOCK,

Vulcanized India-Rubber Works,

GOSWELL MEWS, AND 268, GOSWELL ROAD,

LONDON, E.C.

THORNELOE AND COMPANY,

34, LONDON WALL, LONDON, E.C.,

GAS AND WATER ENGINEERS,

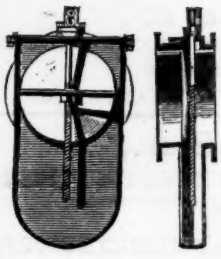
AND

CONTRACTORS FOR GAS AND WATER WORKS APPARATUS.

SHOW-ROOMS AND WHOLESALE WAREHOUSE FOR

Wrought-Iron Tubes & Fittings for Gas, Water, & Steam; Chandeliers, Pendants, Lamps and Brackets, Plumbers Work, Water-Closets, Pumps, &c. Lead, Composition, Brass, and Copper Tubes.

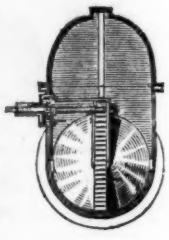
PATENTEES OF THE



NEW FLEXIBLE VALVE

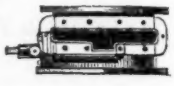
FOR

GAS & WATER WORKS.



This Valve has been designed to meet what has hitherto been felt a great want, in Gas-Works especially—namely, a *really tight* Valve which could be depended upon.

The new Valve is simple in construction, not liable to get out of order, cheap in price, and the principle can be adapted to every part of Gas Apparatus where a Valve is required.



Drawings, Price Lists, and further information sent on application.

Agents for

Messrs. NEWTON, CHAMBERS, & Co.,

THORNCLIFFE IRON-WORKS, CHAPELTOWN, near SHEFFIELD,

MANUFACTURERS OF

Gas Apparatus, Gasholders, Scrubbers, Condensers, & Purifiers;

Iron Main-Pipes, Valves, & Fittings for Gas and Water; Wrought-Iron Retort-Lids; Wrought & Cast Iron Girders, Bridges, Piers, &c.

FULLERTON, SON, & CO.,

GAS-METER MANUFACTURERS,

LONDON ROAD METER-WORKS, EDINBURGH,

SOLE MANUFACTURERS OF

THE PATENT IMPROVED TIN-PLATE DRY METER;

With special facilities for adjusting and repair, the principal parts of the mechanism being accessible by the removal of a single screw.

Gas-Meters on the Wet and Dry principles made in Cast-Iron and Tin-Plate Cases.

Station-Meters, Governors, Experimental & Test Meters, Gas Apparatus, &c.

LONDON AGENTS:

THORNELOE & CO., 34, London Wall, City, E.C.,

Where Meters are supplied to order from Stock.

TO GAS COMPANIES, ENGINEERS, BUILDERS, &c.

THE PATENT ANTI-GALVANIC PAINT

Is guaranteed to prevent and arrest Rust on all Ironwork, and to cover Tar most effectually. It is most valuable for protecting it from the action of salt water, rain, sulphurous and gaseous exhalations. It has been well tested at various Gas-Works, in covering Tar on Gasholders, Purifiers, &c., and has given great satisfaction.

Testimonials given if required, and sample cans for trial sent free of charge.

All communications to be addressed to

Messrs. STEVENS & CO., 156, CHEAPSIDE, LONDON.

GAS COMPANIES & LOCAL BOARDS

Requiring New Street-Lamps are recommended

KEEN'S PATENT DOUBLE-CLIP STREET-LAMP

A great improvement on the old-fashioned 14-in. Lamps.

They have been sold to various Gas-Works throughout the country, and the highest satisfactory testimonials are given as to their superiority.

For particulars of price, &c., apply to

EDWARD JEEVES, Manufacturer, WEYBRIDGE, SURREY.

TO INVENTORS & PATENTEES.

MR. W. H. BENNETT,

Having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 42, Parliament Street, WESTMINSTER. [Office of the JOURNAL OF GAS LIGHTING, &c.]

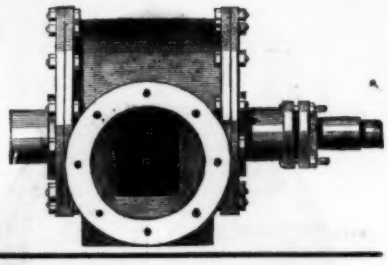
ROTATORY AND DOUBLE-ACTING GAS-EXHAUSTERS,

With many recent improvements, from 1500 to 150,000 cubic feet per Hour.

JAMES BURTON, SONS, & WALLER,

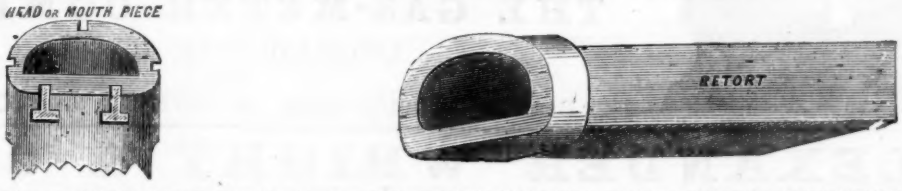
MAKERS OF ENGINES, MACHINERY, and IRONWORK for GAS-WORKS,
Efficient and durable TAR, LIQUOR, and SYPHON PUMPS,
GAS-VALVES, with or without Wedges, worked with powerful Worm and Rack,
SELF-ACTING BY-PASS VALVES, with Lid and Relieving Lever,
ROTATORY, TUMBLER, and CAPILLARY WATER DISTRIBUTORS for SCRUBBERS.
SMALL-SIZE EXHAUSTERS KEPT IN STOCK.

JOHN'S PLACE, HOLLAND STREET, SOUTHWARK, LONDON, S.E.



KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.



KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

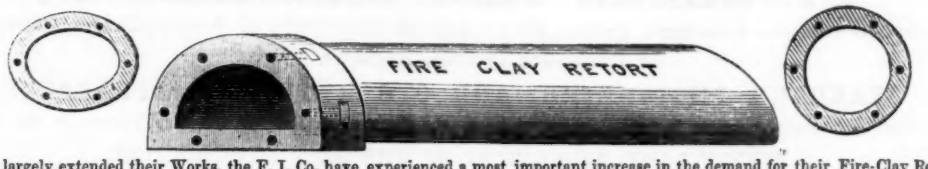
Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Burs, Flues, and Quarries, are all Manufactured of the same quality of Clay.

Every Retort and Brick is branded "King Brothers, Stourbridge."

Agent in Ireland—Mr. JAMES FURNESS, No. 3, FOWNES STREET, DUBLIN.

THE FARNLEY IRON COMPANY,

FARNLEY, near LEEDS.



Since they so largely extended their Works, the F. I. Co. have experienced a most important increase in the demand for their Fire-Clay Retorts, which they owe chiefly to the superior quality of their make, and to the facilities they now possess for executing orders promptly, either for *home* or for *export*.

The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.

The F. I. Co. generally hold in stock, for immediate supply, Fire-Bricks of every size and kind—Tiles, Sanitary Tubes, Ornamental Terra-Cotta Ware White Facing Bricks, the White, Buff, and other Glazed Bricks and Tiles, in various colours and shapes, &c., as well as the Brown Salt-Glazed Bricks, &c., &c.

Prices, Drawings, and all other information may be obtained by applying as above, or to

MR. SUTTON, THE HULL STORES, 46½, QUEEN STREET, HULL.

PARIS, 1867.

CLASSES 24 and 53.

WILLIAM SUGG,

GAS ENGINEER.

LONDON, 1862.

CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS,

LAMP METERS AND BOXES.

LOWE'S JET PHOTOMETERS CAN NOW BE RATED TO 14 CANDLES.

VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS.

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

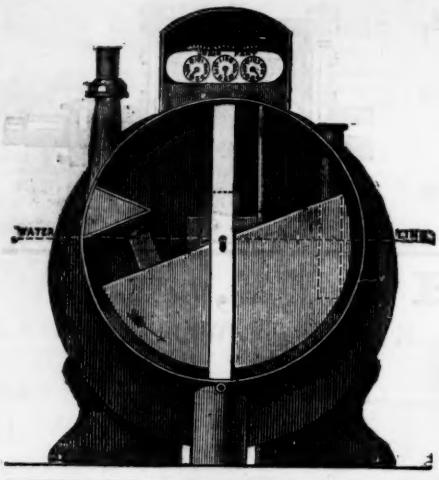
FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON AGENT:

MARCUS BOURNE NEWTON,

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.



THE

UNVARYING WATER-LINE GAS-METER.

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."

Over 60,000 in action.

MANUFACTURERS:

THE GAS-METER COMPANY,

KINGSLAND ROAD, LONDON;

WITH

Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,

55 and 55A, MILLBANK STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

COMPENSATING & OTHER WET & IMPROVED DRY GAS-METERS,

Of the best material and workmanship, carefully adjusted to meet the requirements of the SALES OF GAS ACT.

STATION-METERS & GOVERNORS,

WRIGHT'S REGISTERING PRESSURE-GAUGE, EXHAUSTER REGISTER, AND REGULATOR;

STANDARD TEST GASHOLDERS;

Consumers' Governors; Inspectors' Pocket, King's, and all other kinds of Pressure-Gauges; Thermometers for Condensers, Pressure Registers, &c., &c.

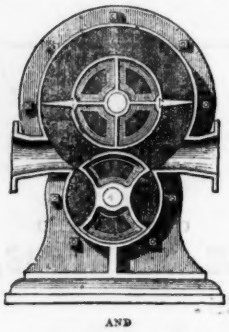
STANDARD PHOTOMETRIC AND OTHER TESTING APPARATUS,

Employed by the best experimenters in this country and on the Continent, and by the Gas Testers in the London districts.

STREET-LAMP REGULATORS OF THE BEST CONSTRUCTION,

Adjusted to any desired consumption.

LAIDLAW'S PATENT GAS EXHAUSTER



AND

ROTARY PUMP.

R. LAIDLAW & SON,

GAS ENGINEERS, CONTRACTORS, IRON & BRASS FOUNDERS,

Iron-Works and Foundries, GLASGOW,

Meter-Works & Brass Foundry, EDINBURGH,

Manufacturers of GASOMETERS & GAS APPARATUS of EVERY DESCRIPTION; CAST-IRON PIPES, all sizes, cast in DRY SAND and VERTICALLY by PATENT MACHINERY; IRON ROOFS, COLUMNS, BEAMS, & GIRDERS; BOILERS, TANKS, & CISTERNS; VALVES, Screw, Rack and Pinion, &c., for Gas and Water, with Iron or Gun-Metal Facings, &c.; WROUGHT-IRON TUBE and FITTINGS for Gas, Water, or Steam; GAS-METERS (Wet and Dry) of the most approved Construction, STATION-METERS, GOVERNORS, &c.; GASELIERS, BRACKETS, PENDANTS, PILLARS, & GAS-FITTINGS of every description; LAMP-POSTS and LANTERNS for Streets, &c.

London Address: SOUTHWARK STREET (near Gt. Guildford St.), BORO', S.E.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT IRON PIPE, BLACK & GALVANIZED. COPPER, TIN, BRASS, & COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER

for clearing out Mains, Services, and Interior Fittings—65s. net.

Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns

Sole Manufacturers of Church and Mann's Photometer.

Large Pattern-Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11 Bolt Court Fleet Street, in the City of London.—Tuesday, September 13, 1870